CIRCULATION LARGER THAN ALL OTHER RADIO MAGAZINES COMBINED

RADIO NEWS

REG. U.S. PAT. OFF.

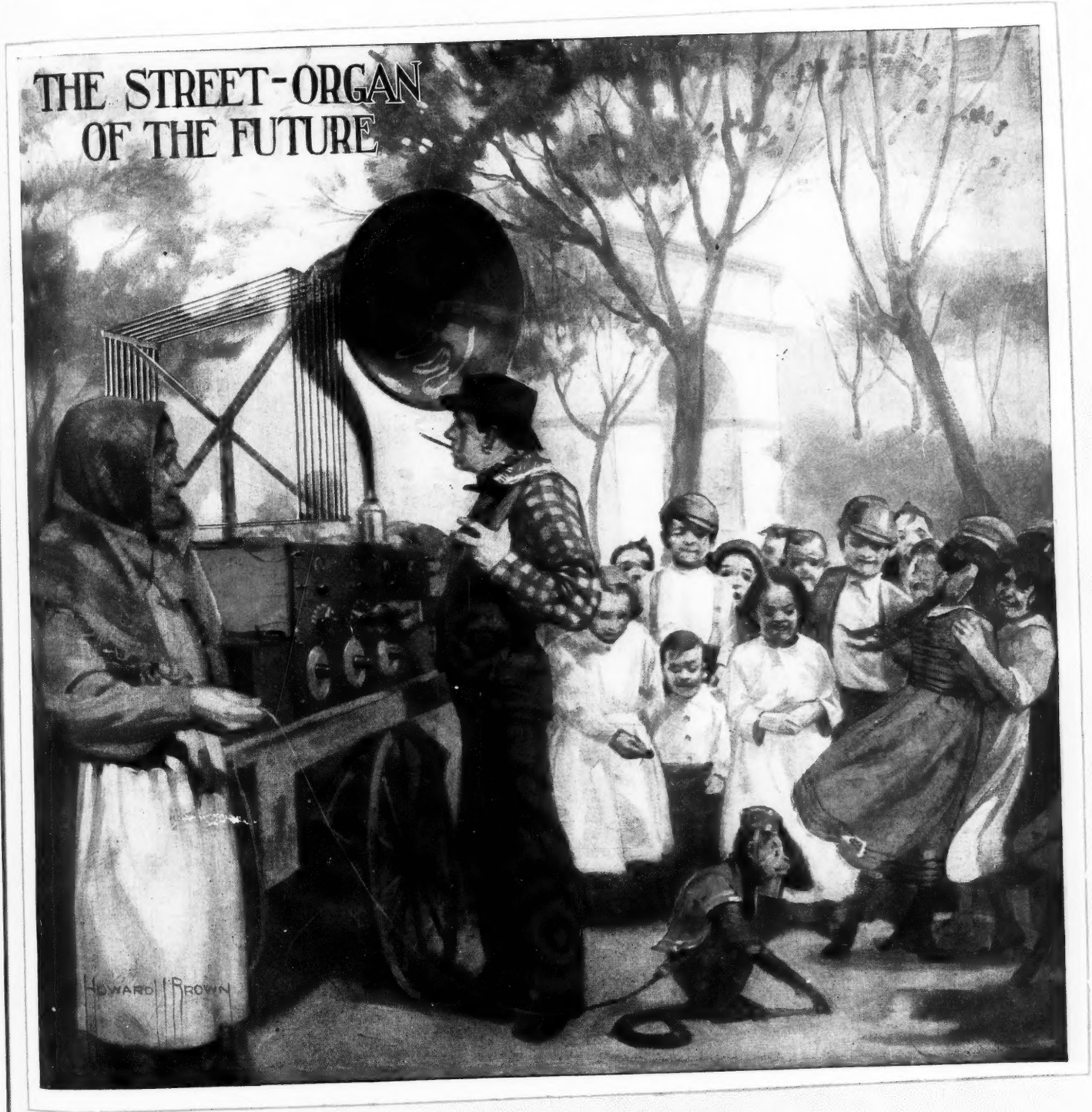
20 Cents

January

1922

Over 100 Illustrations

Edited by H. GERNSBACK



"THE 100% WIRELESS MAGAZINE"

Cunningham Tubes
Speak for themselves

Amplifies as it detects

Cunningham
C-3000
Gas Content
Detector

$5.00

Mr. E. T. Cunningham,
248 First St.,
San Francisco, Cal.

Alexis, Ill.

Dear Sir:

Below are recorded some of the results I have obtained with the C-300.

I had been using the --- Tubes and thought there were none better. When I placed the C-300 in my panel, the first thing I noticed was the lack of "hissing" which one company claims as an advertising point; personally, I never enjoyed it. The first station to "come in" was a spark--it was clear and strong. The tube made no noise whatever to spoil the tone, but the best of it was that I had never heard this station before, although I had tried to a number of times. When I threw in the two stage, it came in clear and before that wonderful "hiss" was one of the loudest noises.

Noting its strength and clearness, I placed it in one of the amplifier sockets and was surprised to note that it did better than the --- Tubes I was using despite the difference in cost.

Its result on C. W. reception was above anything I could have expected. Under very critical adjustment, I found that the signals were audible about six feet from the phones, while with the above mentioned make it was barely readable. There is a radio-phone station about fifty miles from here to which I used to listen with the receivers on tight and all the doors shut. With the C-300 as a detector, I lay the head-phones on the table and forget all about the set.

I have experimented with a small C. W. outfit and it does fine on 22-1/2 volts.

I am very sorry that I did not get to communicate with you sooner but my work here was rather pressing.

At any time you get out new apparatus, will you please send literature covering it. As you are connected with the Remler people, will you be kind enough to send their catalog and prices

Wishing you success, I beg to remain,

Yours very truly,
Frank R. Churchill
Frank R. Churchill

Radio 9AOV

The trade mark GE is the guarantee of these quality tubes. Each tube is built to most rigid specifications.

E. T. Cunningham

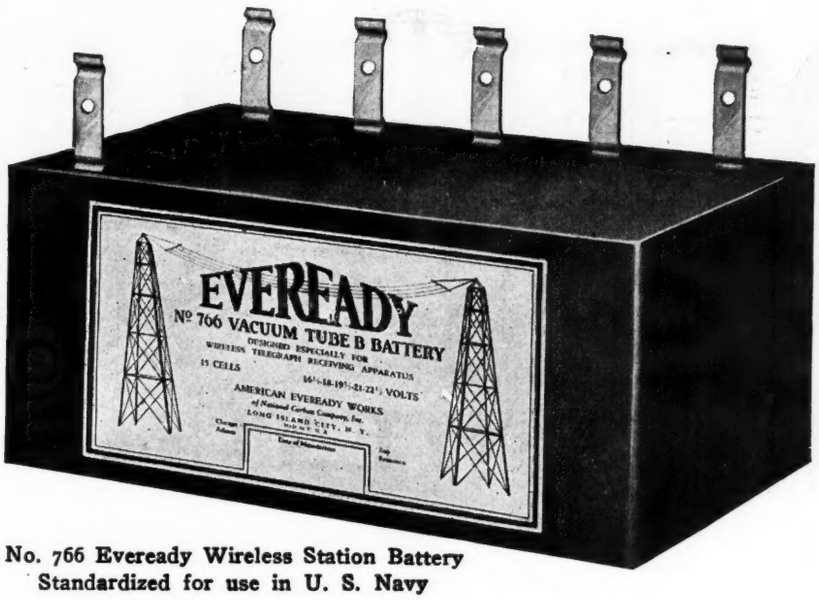
Trading as

AUDITRON MFG. COMPANY

248 First Street
San Francisco, Cal.

154 West Lake Street
Chicago, Illinois

REMLER APPARATUS RADIATES QUALITY
CUNNINGHAM TUBES MEET EVERY AMATEUR REQUIREMENT



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What gives the Eveready Wireless B Battery its high voltage maintenance?

THE right proportioning of ingredients —the retardation of destructive chemical reactions—the control of electrolysis —the perfect insulation.

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No. 763 Eveready Airplane Wireless Battery. Standardized for use in U. S. Signal Corps Aviation Section

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A-25-TE

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RADIO NEWS

CONTENTS

VOL. 3 FOR JANUARY No. 7

	Page
Editorial.....By H. Gernsback	585
Radio Comes to the Aid of the Autoist, By Raymond Francis Yates	586
The New Wavemeter of the Bureau of Standards.....By S. R. Winters	587
A New French Portable Radiophone Set	587
The Radio Direction Finder, By F. W. Dunmore	588
A New Type of Auxiliary Set for Life Boats	589
Amateur Long Distance Using Radio Frequency Amplification..By J. M. Chapple	590
The Phonoscope	591
New Receiving Set for the "Fan," By A. Henry	592
Radio Business is Booming. By Arthur H. Lynch	592
Radio Reception by Means of the Senses of Sight and Touch, By Lynde Freeman	593
Radio Frequency Amplification, By Robert E. Lacault	594
Radio Digest	595
A Radio Control System..By Austin Riu	596
Who's Who in Radio—Valdemar Poulsen.	597
Faults of the "Q" List, By W. T. Burford	597
A 150-20,000 Meter Receiver, By D. R. Clemons	598
A Novel "B" Storage Battery, By R. U. Clark, 3d	599
The Construction of Lattice-Wound Voriometers...By Allan R. Kenworthy	600
A Simple and Efficient Adjustable Condenser.....By Alfred E. Whitburn	600
Experimenting With Amplifiers, By Ray Dio	601
A Relay Key.....By Paul G. Edwards	601
The C.W. Transmitter at 1AFV, By F. C. Estey	602
Blazing the Amateur Radio Trail, By Old Timer	604
The Fable of the "Ham" and the 4KW, By Chas. K. Fulghum	605
Over the Wireless Phone, By Erald Schivo	605
Junior Radio Course.....	606
That $1 Radio Set..By Robert E. Lacault	607
The French Coast Station System, By J. Brun	608
With the Amateurs.....	611
Club Gossip	613
Who Can Use This Man? By "The Wanderer"	614
Correspondence from Readers.....	614
New Radio Patents.....	615
I-Want-To-Know	616

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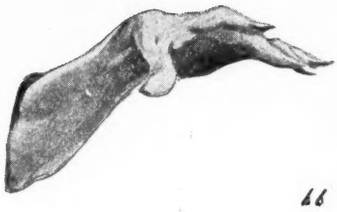

Confucius has said:
"The accomplishment
of great things
consists
In doing small things"
Well
Perfection of
detail
makes the
Grebe Receiver
What
It is—

The Grebe CR-5 Receiver

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Montgomery Ward & Company was the first institution to adopt the guarantee of Satisfaction or Your Money Back. This guarantee applies to all radio goods shown on this and the following pages. Order any of the apparatus on these pages and give it a 5 day examination. If at the end of 5 days it is not what you expected it to be, return it to us and we will promptly return your money together with the transportation charges you have paid.

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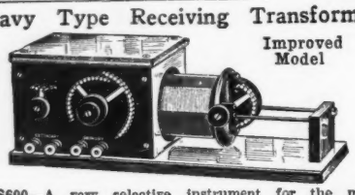
Navy Type Receiving Transformer

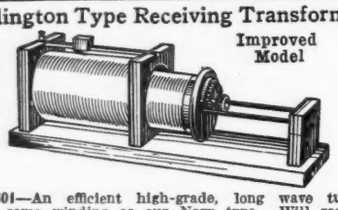
Improved Model



63S600—A very selective instrument for the more advanced stations. Primary inductance is controlled in steps by units and tens switches. Secondary has 12-point control. Has wave range up to 4,000 meters. Formica panels. Metal parts of brass polished nickel finish. Single silk covered windings. Mahogany finished wood work. Base is 18 inches long, 6½ inches wide. Shipping weight, 25 lbs. Price **$17.50**

Arlington Type Receiving Transformer

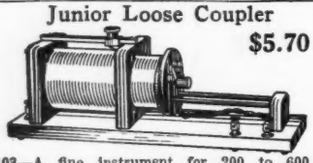
Improved Model



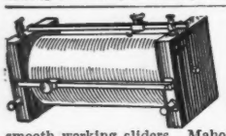
63S601—An efficient high-grade, long wave tuner. Has same winding as our Navy type. Will receive all government time stations such as Arlington and Key West. Works up to 4,000 meters. Primary controlled by slider. Secondary inductance varied by a 12-point switch mounted on Formica, silk covered wire windings. Brass metal parts polished and lacquered. Mahogany finished wood work. Base, 18 inches long, 6 inches wide. Shipping weight, 14 pounds. Price **$7.70**

Junior Loose Coupler

$5.70



63S5103—A fine instrument for 200 to 600 meter work. Primary controlled with slider, secondary by 5 point switch. Metal parts brass, polished and lacquered. Woodwork mahogany finish. Base 12x3½ in. Ship. wt. 6 pounds. Price..... **$5.70**



Two Slide Tuning Coil

63S5104 — Machine spaced enameled copper wire winding. Non-shrinkable tube. Control is by means of two smooth working sliders. Mahogany finished end pieces. Range up to 1,000 meters on average antenna. Length, 8¾ in. Ship. wt. 4 pounds. Price.. **$3.45**

Loading Coil

63S5105—Essentially the same as two slider tuning coil, but has only one slider. Will add about 300M range to any set. Shipping weight, 3 lbs. Price **$3.20**

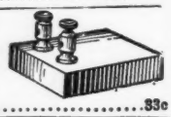
Universal Detector

63S5304—A detector of correct construction. Permanent adjustment. Galena, silicon and other minerals can be used. Moulded base and adjustment knob. Metal parts of brass, polished nickel finish. Tested piece of silicon included. Base size, 2½x3½ in. Ship. weight., 1 lb. Price.... **$1.55**

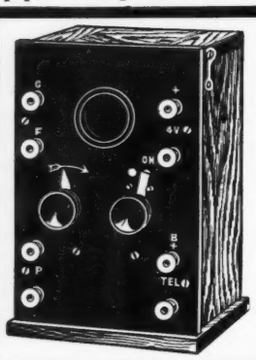
Murdock Detector Stand

63S5302—A good low priced detector stand. Will do very satisfactory work. Moulded black composition base. Adjustable cup and contact. Nickel plated binding posts. No crystals included. Size, 2⅝x1½x2 in. Shipping weight, 4 oz. Price **65c**

Mica Grid Condenser



For use in grid circuit of vacuum tube. Cap., .0005 M.F. Weight, 8 and 2 oz.
63S5330—Mounted in mahogany base. Price.....65c
63S5331—Unmounted. Price.....33c



Vacuum Tube Control Detector Cabinet

An efficiently arranged fine looking detector cabinet. The best value and the highest grade instrument we have found. Standard V.T. base mounted on back of panel. V.T. may be observed through window. Filament control rheostat. Grid condenser. Nickel plated binding posts with marked connections. Fine quality cabinet, weathered oak finish, hinged at top so that interior is easily accessible. Bakelite Panel size 7½x5¼ in. Shipping weight, 6 pounds.
63S5170—Detector cabinet **$11.65**

Vacuum Tube Amplifier Cabinet

Arranged to work in conjunction with any V.T. detector cabinet. Being of the same size and construction as our special detector cabinet the two make a desirable combination. Standard V.T. base mounted on back of panel. V.T. may be observed through window. Filament control rheostat. Improved amplification transformer. Nickel plated binding posts with marked connections. Fine quality cabinet, weathered oak finish, hinged at top so that interior is easily accessible. Bakelite Panel size 7½x5¼ in. Ship. wt., 7 lbs.
63S5172—Amplifier cabinet **$15.95**

Radiotron Vacuum Tube Detector

63S5194—This is a "soft" tube especially suited for detector use and is also an excellent audion frequency amplifier. It produces excellent results in regenerative circuits. Has the familiar hissing point and low B battery potential requirements. Standard four-prong mounting. Shipping weight, 1 lb Price **$4.65**
63S5620—4000 ohm potentiometer graphite. Often used with soft vacuum tubes. Price..... **69c**

Improved V. T. Socket

63S5343—Improved long flat spring contacts insure positive contact on any standard tube base prongs. Glossy black composition base. Nickeled tube. Marked screw connections. May be used and wired in any position. Shipping weight, 8 ounces. Price **95c**

Grid Leak

63S5341—Pencil mark type variable high resistance. When shunted across, stopping condenser keeps potential of grid of such a value, that paralyzation is prevented, and most efficient results are obtained. Ready to mount on panel. Ship. wt., 3 oz. Price..... **56c**

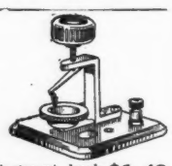
Vacuum Tube Control Panel

63S5108—A compact, handy V.T. panel. Standard socket, rheostat, grid condenser, grid leak and binding posts all mounted on moulded bakelite panel. Metal parts polished nickel finish. A high grade, inexpensive instrument that will do as good work as the highest price cabinet. Base size, 3⅛x5 in. Shipping weight, 2¾ lbs. Price **$5.65**

Weatherproof Detector

63S5303—Very rugged. Perfect easy adjustment. Phosphor bronze contact spring can be set and locked in any position. A piece of tested galena set in Wood's metal is mounted inside dust and moisture proof enclosed glass cylinder. Formica base, 2x2x⅝ in Ship. wt. 1 lb. Price **$2.45**

Standard Galena Detector



63S5305—A popular detector. Tested piece of galena is mounted in cup which can be rotated. Crystal contact of phosphor bronze wire coiled and pointed and soldered on flat spring. Very fine adjustment obtainable with screw. Moulded base and adjustment knob. Base, size 3x3 in. Ship. wt., 1¼ lbs. Price. **$1.43**

Detector Crystals

Genuine Arlington Tested Minerals. Absolutely the best crystals that can be purchased for any price. All are thoroughly tested and guaranteed. Extremely sensitive. Packed separately in sealed boxes. Shipping weight about 3 ounces. **22c**
63S5320—Supersensitive Galena, per crystal... 22c
63S5322—Supersensitive Silicon, per crystal..... 22c
63S5324—"Radiolite." Per crystal..... 18c

Radiotron Vacuum Tube Amplifier Oscillator

63S5192—A high vacuum amplifier and detector. Requires no critical adjustment. Designed for amplification and undamped wave reception by the regenerative method. May be used singly for receiving continuous waves or in cascade as a two or more step amplifier. Shipping weight, 1 lb. Price..... **$6.25**

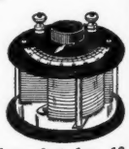
Socket for Vacuum Tube

63S5342—Socket is mounted on bakelite sheet. Four binding posts for connections. Screw holes for flat mounting, screws in side of base for panel mounting, permitting either upright or vertical position of tube. Shipping weight, 8 ounces. Price **$1.35**

Variable Condenser for Panel Mounting

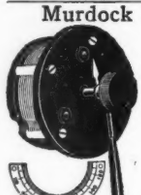
63S5173—The best value in high grade variable condensers. Rugged, durable construction. 13 aluminum stationary plates, 12 rotary plates. Overall dimensions 4⅝ in. high, 3¼ in. wide, 3 in. long. Bakelite knob. Etched scale. Cap., .0005 M. F. Shipping weight, 1 pound. Price **$6.25**

Murdock Variable Condenser, Enclosed Type



63S5175—Murdock No. 367. Polished black composition top and bottom with transparent enclosing cylinder, 22 stationary plates, 21 movable plates. Cap., .001 M.F. Diam., 3⅞ in. Height, 3¾ in. Binding posts and arrow pointer are nickel plated. 180 degree engraved scale. Shipping weight, 2¼ lbs. Price **$4.20**
63S5177—Murdock 368. Same as above but has 12 stationary plates and 11 movable. Capacity, .0005 M.F. Shipping weight, 1½ pounds. Price **$3.78**

Murdock Panel Type Variable Condenser



63S5179—Twenty-three plate .0005 M.F. capacity. Ruggedly assembled for panel mounting. Complete with mounting screws, knob, pointer, engraved 180 degree scale and anti-capacity handle. ¼ in. shaft. Any standard knob or dial may be used. Requires space 3½ in. wide; 2 in. deep for mounting. Shipping weight 1½ lbs. **$3.38**
Murdock No. 3681. Price
63S5181—Forty-three plates. Capacity .001 M.F. Complete as above. Requires space 3⅝ in. wide, 2¾ in. deep for mounting. Ship. wt., 2½ lbs. **$4.10**
Murdock No. 3661. Price.....

Knocked Down Variable Condenser

Furnished complete but unassembled. Intended for panel mounting and are complete with scale pointer and knob. Formica tops and bases. Shipping weight, 1¼ lbs.
63S5183—Capacity, .001 M.F. 41 plates. **$3.20**
Price .....
63S5185—Capacity, .0005 M.F. 21 plates. **$2.25**
Price .....

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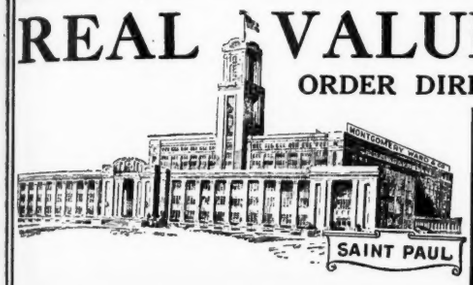
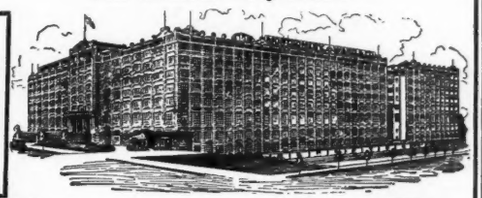


Our Kansas City Store



Send for Our Big Catalog

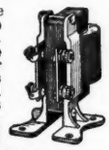
We show a complete line of electrical goods in our New General Catalog. If you are interested in motors either large or small, wiring materials, lamps, transformers, meters, etc., you should have a copy of this new book. In addition to electrical goods it contains a complete line of tools, automobile accessories and merchandise of all kinds which will be of interest to the entire family. A copy will be sent free on request. Kindly mention Radio News.

Combined Detector and Amplifier

This instrument in connection with a set of inductance coils, two variable condensers, batteries and a good aerial will permit of the reception of all classes of radio signals over an extremely broad range. Used in conjunction with our Regenerative set you have a receiving outfit that can only be excelled by adding additional stages of amplification. Detector and amplification tubes mounted inside of cabinet and are provided with rheostat control. Detector provided with grid condenser. High efficiency amplification transformer between detector and amplifier circuit. Jacks are wired in detector and amplifier circuit and a plug supplied for phones permitting use of detector or amplifier as desired. Dull finish bakelite panel, 7½ in. high, 6⅜ in. wide. High grade weathered oak finish cabinet with hinged top, making interior easily accessible. Binding post connections for batteries and couplers. No tubes, batteries or phones included. Brass metal parts. Binding posts oxidized finish. Shipping weight, 12 pounds.

63S612—Price **$23.95**

Amplifying Transformer



63S5140—Will positively increase the strength of incoming signals up to twenty times the original audibility. Scientifically designed to work with the vacuum tubes supplied for amateur use. One of the best devices in its class. It is of the iron core type and is supplied with binding posts and lugs for mounting. Height, 2½ in. Shipping weight, 1 pound.
Price **$3.75**

63S5141—Same as above but not mounted. Price **$2.95**

General Radio Amplifying Transformer

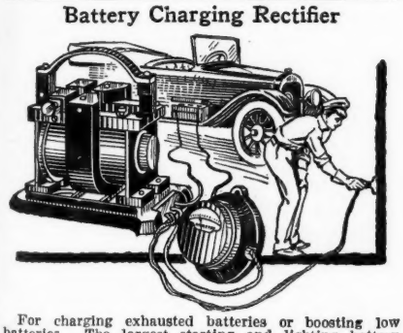
We believe this to be the most efficient, best designed and best constructed Amplification Transformer on the market. It is compact and by means of the four projecting feet, each with a screw hole, may be mounted in any position. The core and coil are finished in black. The mounting brackets and binding posts are finished in nickel. Size 2⅝x2½x2½ in. Ship. wt., 1 lb.

63S5188—As illustrated. Price..... **$4.60**

"A" Storage Battery

63S498—Six volt, 60 amp. hour storage batteries for filament circuit. This is a high grade battery and will give long, satisfactory service. Weight, 30 lbs.
Price **$14.85**

Battery Charging Rectifier



For charging exhausted batteries or boosting low batteries. The largest starting and lighting battery can be charged for a few cents—usually less than 10 cents even on high rates. Just screw plug into the light socket, attach leads to battery and turn on current. Large connecting clips make it easy to hook on to any battery.

Note: These rectifiers are for use only on 105 to 115 voltage 60-cycle alternating current, which is the usual city lighting current. Will not work on direct current nor 25-cycle currents.

Prices include 10-foot connecting cord with socket plug, ammeter, battery leads and two clips. Length, 7 inches, width, 5 inches, height 7 inches.

63S6193—Charges 6-volt battery at 7 amperes rate. Shipping weight, 10 pounds. Price delivered each **$13.95**

63S6191—Charges 12-volt battery at average rate of 5 amperes. Shipping weight, 14 pounds. Price delivered, each **$13.95**

Vacuum Tube Plate Circuit Battery

Composed of 15 cells in series—22.5 volts. Each cell separately insulated and the whole unit compactly assembled and sealed together. Flexible leads from end cells. Polarity plainly marked.

63S5618—Signal corps standard size, 3¼x2x2½ in. Shipping weight, 2 lbs.
Price **98c**

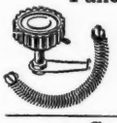
63S5621—Navy standard, size, 6¼x4x3 in. Shipping weight, 5 lbs. Price..... **$1.65**

Porcelain Base Rheostat

German silver winding on threaded fibre strip imbedded in porcelain base. Smooth easy action. Moulded knobs, 1⅛ in. diameter. Resistance, 11 ohms. Capacity, 3 amperes. Diameter. 4 inches. Shipping weight, 1½ lbs.

63S5313—Front mounted. Price..... **88c**

Panel Mounting Rheostat



63S5316—An ideal rheostat for filament control. Enameled resistance wire wound on bakelite form. Resistance 5 ohms. Capacity 2 amperes. Complete with knob, shaft, nuts and pointer. Ship. wt., 3 oz.
Each **$1.05**

Combination Rheostat

63S5318—For either panel or table mounting. Especially desirable for panel mounting. Requires space only 2½ in. diam. and ⅞ in. deep. Moulded condensite base and knob. Smooth operation. Easy connecting and assembling. Resistance 6 ohm. Capacity 1½ amperes. Shipping weight, 8 oz.
Price **$1.42**

Unmounted Honeycomb Inductance Coils

High grade efficient inductance coils at attractive prices. Claimed by many users to be the best on the market. Made firm by varnish impregnation. Shipping weight, 4 to 16 oz. Wave length is in meters with .001 M.F. condenser. Not mounted.

Article Number	Number Turns	Approximate Wave Length Range	Price
63S5470	25	130— 250	39c
63S5471	35	180— 450	42c
63S5472	50	250— 700	49c
63S5473	75	400— 900	55c
63S5474	100	500— 1,000	59c
63S5475	150	600— 1,200	62c
63S5476	200	1,000— 2,500	65c
63S5477	300	1,500— 4,500	73c
63S5478	400	2,000— 6,000	78c
63S5479	600	4,000—10,000	98c
63S5480	1,000	8,000—15,000	$1.38
63S5481	1,250	10,000—20,000	1.72
63S5482	1,500	16,000—25,000	2.17

Test Buzzers

63S5345—Watch case buzzer. Operates on one dry cell. Nickel plated cover and base. 1 inch high, 2⅛ inches diameter. Ship. wt., 8 oz. Price..... **85c**

Receiver Cord

63S5385—Double receiver green mercerized cord, 6 feet long, for use with any standard receiver. Price. **70c**

Century Buzzer

63S5346—Used by the Army and Navy and commercial wireless stations. For adjusting crystal detector. Operates on one or two dry cells. Base is hard rubber with black enameled brass cover. Two thumb screws provide for adjustment of the armature to regulate the tone to desired pitch. Genuine Platinum Contacts. Diameter of base, 2 in. Ship. wt., 6 oz.
Price **$1.65**

Test Buzzer Push Button

63S5137—For use with test buzzer. Nickel rim with pearl center. Held firmly in ⅝ inch hole by small spring clips. Ship. wt., 4 oz.
Price **25c**

Murdock No. 55 Head Sets

These sets have given excellent service to thousands of users. Thin extra responsive diaphrams, fine quality permanent steel magnets, enameled copper wire windings. Nickel silver adjustable headband, complete with 5-foot cord. Ship. wt., 1½ lbs.

63S5370—Double set, 2000 ohms (total).
Price **$4.25**

63S5371—Double set, 3000 ohms (total). 5.20

Brandes High Grade Receivers

The Brandes line of receivers is the very finest. They are used throughout the world and are famous for their excellent workmanship, durability and extreme sensitiveness. All have the new Brandes type head band, which is comfortable, easily adjusted, very light and will not catch the hair. Fitted with 6-ft. polarity indicating cord. The phones of each set have carefully matched tones. Ship. wt., 2 lbs. per set.

63S5380—Superior type, total res. 2000 ohms. Complete. Wt., 14 oz. Price..... **$7.70**

63S5382—Navy type, total res' 3000 ohms' Very sensitive. Complete. Wt., 9 oz. Price..... **$13.10**

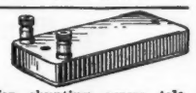
Learner's Head Set

63S5383 — Scientifically constructed for radio use. Should not be confused with ordinary telephone receivers sometimes furnished. These sets are just the thing for those who wish a low priced sensitive radio head set. Res. 1000 ohms. Ship. wt., about 1¼ lbs. Price—$2.45

Watch Case Receiver

63S5384—Regulation watch case type telephone receiver. Moulded composition case. Bipolar. Resistance, 80 ohms. Ship. wt., 12 oz. Price, each.. **$1.05**

Fixed Receiver Condenser



A necessity on every receiving set. Used as "stopping" condenser or for shunting across telephones. Moulded composition bases. Nickel plated binding posts. Ship. wt., about 8 oz.

63S5362—Capacity, .01 M. F. Price..... **85c**

63S5364—Capacity, .005 M. F. Price..... **65c**

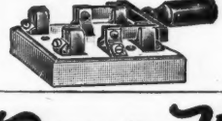
Knife Switches

Porcelain base switches. Contacts and blades made of heavy copper. Intended for low voltage currents, but can be used on 125 volt current to carry load not over 15 amperes.

63S2684—Single pole single throw switch. Base, size, 1⅛x3⅛ in. Ship. wt., 6 oz.
Each **22c**

63S2686—Single pole, double throw switch. Base size, 1⅜x3⅞ in. Ship. wt., 10 oz.
Each **30c**

63S2687—Double pole. Single throw switch. Base, size 2x2⅝ in. Ship. wt., 10 oz. Each.. **39c**



63S2689—Double pole Double throw switch. Base, size, 2⅝x4 in. Ship. wt., 1 lb.
Each..... **48c**

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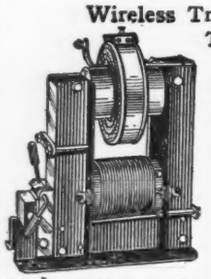
Wireless Transformers

Thordarson Type R



For use on 108 to 115-volt alternating current, 60 cycles. Generally accepted as the standard transformer for amateur transmitting. Provided with adjustable magnetic leakage gap which controls primary input giving a wide range of amperage and permitting easy adjustment to point of resonance. No impedance or choke coil necessary in primary circuit. Ship. wt., 35 and 55 lbs.

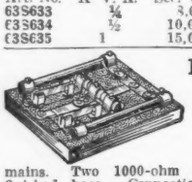
Art. No.	K. V. A.	Amp.	Sec. Volt	Price
63S630	⅛	1 to 6	10,000	$21.00
63S632	1	2½ to 14	25,000	38.00

Thordarson Type R. S. Transformer

This type differs from the well known model shown above only in that it does not have the adjustable magnetic shunt. All other features of sturdy, compact construction and correct electrical characteristics are the same. For use on 105 to 120 volt 60 cycle alternating current.

Art. No.	K. V. A.	Sec. Volts	Ship. wt.	Price
63S633	¼	3,000	15 lbs.	$10 00
63S634	½	10,000	25 lbs.	19 00
63S635	1	15,000	35 lbs.	28.50

Kick Back Preventer



63S5358—Prevents high frequency surges from discharging back into power line. A necessity when power transformer is supplied from city mains. Two 1000-ohm resistance rods. Mahogany finished base. Connections of strip copper. Ship. wt., 4 lbs. Price..... $4.80

Variable Transmitting Condenser—Oil Immersed

63S620—An oil immersed variable condenser for use with all makes of transformers up to 1 K. W., 25,000 volts. Phenol fibre dielectric, corrugated aluminum separators allow circulation of oil to keep down heating. Flat aluminum sheet electrodes with rounded corners. Variable in ten steps of .0009 M. F. each from .0018 M. F. to .009 M. F. Especially designed to prevent corona losses and brush discharge. Oil included. Ship. wt., 35 lbs. Price..... $25.00

Wireless Spark Coils

For use on dry cells or storage batteries. Properly adjusted the half- inch coil has a sending range of from 2 to 5 miles, the one-inch coil 5 to 10 miles. Ship. wt., 6 and 8 lbs.

63S5126 — Half inch coil..... $3.65

63S5127—1 inch coil..... $5.95

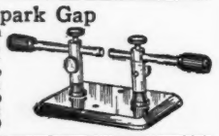
Spark Coil Transmitting Condenser

63S5348—Designed for use with spark coil sets, dielectric of 5—size, 5x7 photo plates. Mahogany finished case. Permits working on 200 meter wave. Ship. wt., 3 lbs. Price..... $1.48

Murdock Improved Antenna Switch

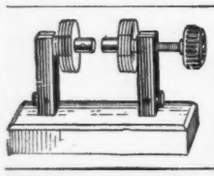
63S5113 — A large sturdy, well built "change over" switch suitable for use on sets up to 1 K. W. Mahogany finish base. Improved support, copper blades. Fitted with third blade to disconnect receiver when sending. Ship. wt., 2½ pounds. Price..... $4.30

Zinc Spark Gap



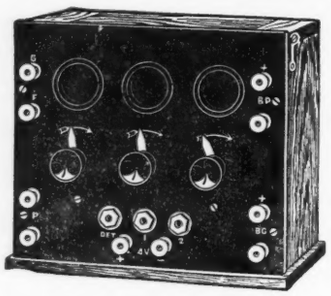
63S5350—For use with spark coil transmitters. Base is moulded composition. Metal parts are plated and polished. Can be used with coils up to 4 inches. Ship. wt., 2 pounds. Price..... $1.10

Radiator Spark Gap



63S5351—Micrometer adjustment. Electrodes of zinc. Cooling vanes aluminum. Metal parts nickel plated. Base glazed porcelain. Will handle over 1 K. W. Weight, 2 lbs..... $2.30

Combined Detector and Two Stage Amplifier



This instrument with the proper accessory instruments has the broadest possible range. So sensitive is it that even with an indoor aerial such as our loop antenna 63S651 messages may be received from stations hundreds of miles distant. Combined with our Regenerative set and two variable condensers and the proper couplers and loaders with a good outdoor aerial, its range is increased to equal the best commercial stations. Has one detector and two amplifier circuits. Standard tube sockets, grid condenser in detector circuit, two amplification transformers, three jacks and one plug so that any desired circuit may be used. Bakelite panel 7½ in. high, 8¾ in. wide. High grade weathered oak finish cabinet with hinged top making interior easily accessible. Binding post connections for batteries and couplers. Binding posts black oxidized finish. No tubes, batteries or phones included. Shipping weight, 18 lbs.

63S615—Price $33.50

Commercial Type Oscillation Transformer

$16.50

63S648—Designed to give wave ranges both above and below 200 meters. Solid copper windings on "Formica" supports 10½ in. diam. primary of six turns No. 3 wire 6½ in. diam., secondary of twelve turns No. 5 wire. Mahogany finished woodwork. Two helix clips included. Ship. wt., 26 pounds. Price..$16.50

Murdock Oscillation Transformer

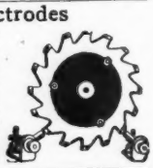
$4.75

63S5155—Permits Sharp tuning on 200 meter wave. Can be used on sets up to 1 K. W. Primary and Secondary windings of edgewise wound copper ribbon. Coupling varied by hinge. Shipping weight, 8 lbs. Price $4.75

Universal Spark Gap Motor

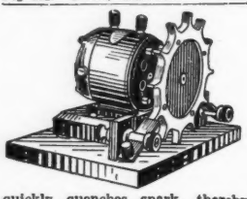
63S5624—A rugged high grade motor for spark gaps, running sewing machines, fans, small lathes, buffers, emery wheels, etc. Running idle will make 8,000 R.P.M. Will make about 4,500 R.P.M. with electrode shown below. Will operate on 100-125-volt A. C. or D. C. current. Black enamel finish. Height, over all, 5½ in. ¼ in. shaft, extends ⅞ in. Will develop about 1/20 H. P. Supplied with 1-in. grooved pulley. Ship. wt., 8 lbs. Price..$9.50

Spark Gap Electrodes



63S5625—Saw tooth rotor, 5⅜ in. diam., of machined cast aluminum with bakelite center and brass bushing to fit ¼-inch shaft. Two adjustable stationary electrodes. This set together with universal motor listed above, mounted on a substantial base will make a high grade rotary spark gap. Ship. wt. 1½ lbs. Price, set..... $4.50

Improved Model Rotary Spark Gap



Flat pure copper electrodes avoid pitting. Width of break adjustable. Strong breeze generated by rotary electrode quickly quenches spark, thereby allowing transmission of wave of low decrement. All conducting metal mounted on Formica. Easily handles 40,000 volts without endangering motor windings. Constant steady speed. Ship. wt., 10 lbs. Shipped from stock at Chicago.

263S5142—½ K. W. size, 1/20 H.P. Universal motor. For 108 to 115-volt current. Speed 4,000 R.P.M. Price..... $14.80

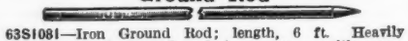
263S5143—1 K. W. size, 1/12 H.P. Universal motor. For 108 to 115-volt current. Speed 5,000 R.P.M. Price..... $18.95

Ground Switch

63S5359—600 volt, 100 ampere double throw single-pole switch on insulating base. For grounding aerial when not in use. Ground wire should be 4 gauge. Ship. wt., 5 lbs. $3.78

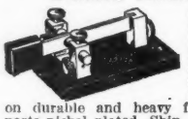
Price.....

Ground Rod



63S1081—Iron Ground Rod; length, 6 ft. Heavily galvanized. A ground rod is necessary with every Radio outfit to insure a perfect ground contact. Shipping weight, 4 lbs. Price each... 43c

Double Action Wireless Key



63S5356—Double action which makes for speed. Will improve your sending and lends individuality. Large standards, formica knob, heavy silver contacts suitable for use up to 2 K. W. Mounted on durable and heavy formica base. Metal parts nickel plated. Ship. wt., 1¾ lbs. Price.. $4.65

Standard Wireless Key

63S5352—A high grade key made of heavy lacquered brass. Large hardened contact points. Ship wt., 1 lb. Price. $3.48

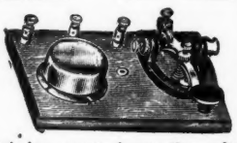
Steel Lever Keys

Shipping wt., 14 oz.

63S1739—Leg Key with legs to go through table or desk. Price, each.... $1.85

63S1741—Legless Key to screw to top of table or desk. Price each $1.97

Wireless Practice Set

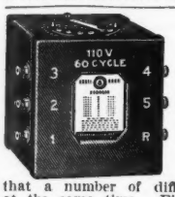


Beginners! Learn the Code!

Anyone learning wireless must know the code. Without it, it is impossible to understand the signals. Send for a wireless practice set and see how easy it is to learn the code. Set consists of a key and buzzer mounted on a polished wood base. Buzzer reproduces accurately the high pitched sounds of wireless stations. Connect a dry battery to the binding posts on the set by means of a short piece of wire, press the handle of the key and buzzing sound will be produced. In a very short time your ear will become accustomed to the various combinations of dots and dashes representing different letters and numerals. Practice until you can understand the signals at the speed sent by average stations and you have completed the most difficult part of wireless telegraphy. A very good way to learn the code quickly is to place two of these sets in separate rooms with an operator at each set and practice sending signals back and forth. Chart included with each set. Base size, 7x4¾ inches. Shipping weight, 3 pounds.

63S1750—Wireless practice set. $2.10

Standard Type Transformer



Operates only when connected onto alternating current line of 100 to 125 volts, 60 to 133 cycles. 100 watt Transformer produces 1½ to 24 volts, 150 watt 1½ to 30 volts in steps of 1½ volts each, and in addition can produce constant voltages, so that a number of different voltages can be drawn at the same time. Fitted with 7 ft. cord and attaching plug.

63S1697—Capacity, 100 watts. Ship wt. 10 pounds. Price..... $4.35

63S1699—Capacity, 150 watts. Ship. wt. 13 pounds. Price..... $5.95

American Ignitor Dry Cell

We guarantee that these batteries will reach you fresh and will give you all the service you have a right to expect of the best 2½ by 6-inch dry cell made. Designed especially for heavy duty work. For radio and for ignition work on gas engine, automobiles, motor boats, etc. Average weight, 2 pounds. Size 2½ by 6 inches. Average initial amperage, 25 to 30 amperes. 37c

63S2501—Price, each.....

63S2502—Price, per dozen..... $4.30

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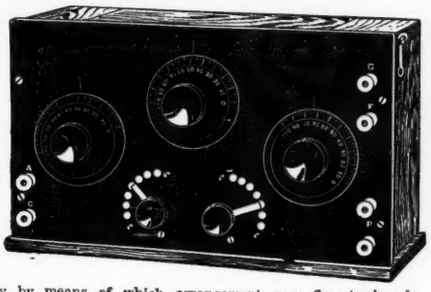
Short Wave Long Distance Regenerator Receiver $31.50

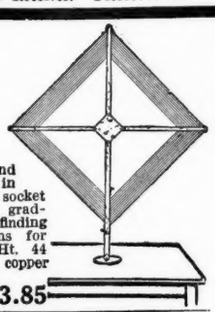


This instrument makes possible the reception of messages to which other types of apparatus will not respond. The range is from 180 to 600 meters and by the addition of external loaders, such as the inductance coils listed on the opposite page, this range may be raised as desired. Properly handled, signals may be read from stations at extreme distances or through heavy static and interference. The antenna and closed circuits are inductively coupled and the coupling is variable. Regeneration is obtained by tuning both the grid and plate circuits to resonance with the incoming signal. Highest efficiency and amplifications are obtained by reducing capacity and resistance in circuits to absolute minimum and best regenerative effects are secured by use of properly designed variometers.

The inductive coupler consists of a primary, the inductance of which is varied by two seven point switches, and a rotating secondary by means of which arrangement very fine tuning is possible. Coupler and both grid and plate circuit variometers are fitted with high grade knobs and indicating dials. A very compact and easily portable instrument. Graduated bakelite panel size 7¼ x 13¾ in. Fine cabinet weathered oak finish, 5 inches deep. Metal parts brass, black oxidized finish. Ship. wt., 26 lbs.

63S610—Regenerative Receiver. Price.....$31.50

Loop Antenna



63S651—Will receive messages from stations 300 miles distant, and much farther under favorable conditions. Wave length, 175 to 300 meters. Comes knocked down complete with brass plates and screws for holding arms in position, brass disc and socket for mounting on table, graduated dial for direction finding and complete instructions for assembling and using. Ht. 44 in. Coil of No. 22 bare copper wire is included. Ship. wt., 5 lbs. Price... $3.85

Indicating Dials and Knobs

Marconi — New Gov. — Reg. — Ideal

Made of moulded black composition. Edges of dials are beveled, radial lines and figures are engraved in and filled with contrasting brilliant white enamel 3/16 in. thick. 39c

63S5655—3-inch Dial only. Price.....

63S5657—3-inch dial with bakelite knob. Price.59c

63S5659—3⅞-in. dial only. Price.....85c

63S5661—3⅞-in. dial with 1⅝ in. government bakelite knob. Price.....$1.31

Black Composition Knobs

Ship. wt., 4 oz. each. Per doz. 1¼ lbs.

63S5665—Marconi style, 1¼ in. diam. Hole for 3/16 in. rod. Each,12c. Per dozen.....$1.10

63S5667—Marconi style 2⅛ in. diam. Hole for 3/16 in. rod. Each, 21c. Per dozen... .....$2.40

New government style. Has brass bushing for 10/32 thread and two holes for stay pins.

63S5669—Diam. 1 inch. Each 11c. Dozen....$1.25

63S5671—Diam. 1-5/16 inch. Each.....14c

Dozen $1.55

63S5673—Regulation 1½-inch knob with 8/32 bushing. Each .....11c Dozen.....$1.08

63S5675—Ideal 1¾-inch knob metal bushing for 3/16 rod with set screw. Each.....20c

Dozen $2.25

Binding Posts and Switch Points

A B C D E F

Made of brass, nickel-plated. Binding posts have ⅝ in. long 6/32 screws with washers. Switch points have ⅝ in. screws or shanks threaded 6/32. Ship. wt., per doz., 12 oz.

63S5636—Binding Post "A," Length, ⅞ in. Each .....9c Dozen 95c

63S5638—Binding Post "B," Length 1-3/16 in. Each .....12c Dozen $1.28

63S5644—Binding Post "C." With bakelite knob. Each.....12c Dozen.....$1.38

63S5646—Switch Point "D." ¼x¼ head with soldering lug. Per dozen.....38c

63S5648—Switch Point "E." Head ¼ in. diam. ⅛ in. high with 2 nuts. Dozen.....45c

63S5650—Switch Point "F." Head ¼ x ¼ with two nuts. Dozen 48c

Grade M Formica Panels

Black sheets. Both sides polished. Waterproof, strong, lasting. Ship. wt., 2 to 8 lbs. Size given is in inches.

63S5688—	7x 9x⅛	Price..... $0.69
63S5690—	14x18x⅛	Price..... 3.15
63S5692—	7x 9x3/16	Price..... 1.20
63S5694—	14x18x3/16	Price..... 4.65
63S5696—	7x 9x¼	Price..... 1.58
53S5698—	14x18x¼	Price..... 5.95

High Frequency Ammeter Jewel Pattern No. 25

An exceptionally accurate instrument. High frequency current heats a thermo-couple and the resultant energy is measured by a sensitive D'Arsonval galvanometer. Well damped, insuring a steady pointer. Temperature variations have practically no effect on the readings. Side terminals avoid making inductive loop in connection. Base diameter, 4¾ in. Ship. wt., 6 lbs.

63S5360—0 to 3 ampere Range. Price... $11.95

63S5361—0 to 10 ampere Range. Price.....$11.95

Hot Wire Ammeter

63S5365—Will measure accurately the radiation in the aerial and ground circuit. A necessity for tuning the transmitter to 200 meter wave. Range 5 amperes. Will stand 100 per cent overload. Base is of hard rubber composition. Nickel-plated rim, size 3½ inches diameter. Ship. wt., 1 lb. Price..... $4.25

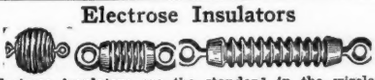
Variometer

63S5640—This is the same high grade variometer that is used in our Regenerative set. With two variometers, a loose coupler and the proper binding posts, dials, knobs, etc., a regenerative set may be constructed at a very low cost. Can also be used separately for grid and plate tuning. Designed for very low dielectric losses and maximum range of inductance. Rotating element contacts made through ¼ in. shaft so that ball may be continuously rotated without breaking connection. Ship. wt., 2¼ pounds. Price.....$4.45

Loose Coupler

63S5642—The same high grade loose coupler used in our Regenerative set. With a loose coupler, two variometers and the proper binding posts, dials, knobs, etc., a regenerative set may be constructed at a very low cost. Can also be used separately. Primary has seven taps which can be connected up to vary inductance. Secondary rotates. Connections are made through shaft. Ship. wt., 3½ pounds. Price $4.20

Electrose Insulators



Electrose insulators are the standard in the wireless field. They stand up under all conditions met with. Eyes are wrought iron galvanized. Ship. wt., ½ to 2½ lbs.

Article No.	Dia. In.	Ov. all In.	Lgth. Strgth Lbs.	Elec. Value Dry Volt	Elec. Value Rain	Price
63S5630	2⅛	3¼	250	40,000	25,000	28c
63S5631	1½	4	1,000	40,000	15,000	42c
63S5632	1½	10½	1,000	90,000	50,000	66c

Electrose Wall Insulators

63S5634—Special Wall insulator for lead in wires. Has hole through body for wire. Body diam., 2 in. Length over all, 5-9/16 in. Ship. wt., 1 lb. Price.....93c

Switch Levers

Smooth in operation, always perfect contact without binding Black composition knobs, diam. 1¼ in. Metal parts of brass nickel-plated. Ship. wt., 4 oz.

63S5651—Complete knob, laminated lever and screw permitting mounting on panels not over ½ inch thick. Each.. 39c

63S5653—Complete knob, spring lever, shaft, two lock nuts and bushing for panels up to ⅝ inch thick. Each.. 49c

Send cash with your order to cover the price of the merchandise you select and transportation charges. Send currency by registered letter only. You take no risk in dealing with Montgomery Ward & Co., as we are one of the largest and most reliable institutions in the world.

Magnet Wire

For repairing motors, other electrical apparatus, experimental work, etc. One piece only on a spool. Wire is standard B and S gauge. Insulation and wire both perfect and uniform. Supplied only in weight spools given.

Double Cotton Covered Magnet Wire Art. No. 63S1350			Belden Enameled Magnet Wire Art. No. 63S1400	
Price 8 oz. Spool	Price 1 lb. Spool	Gauge	Price 8 oz. Spool	Price 1 lb. Spool
$ .65	$ .95	14	$ .45	$ .85
.69	1.03	16	.46	.87
.74	1.12	18	.48	.92
.84	1.34	20	.62	.94
.92	1.54	22	.65	.98
1.02	1 74	24	.70	1.10
1.18	2 06	26	.76	1.20
1.46	2.62	28	.85	1.38
1.64	2.98	30	.88	1.42
1.95	3 58	32	.92	1.52
2.84	5.34	36	1.20	1.98

New Code, Rubber Covered Wire, Single Braid

Solid conductor copper wire, insulated with rubber compound over which is one cotton saturated braid. Ship. wt., 3 and 13 lbs. per 100 ft. Sold only in lengths listed.

63S3015—Size 14. Price for 25 ft.....$0.32

Price for 100 ft...$1.17 Price for 500 ft.....$4.95

63S3032—Size 6. Price for 10 ft..... .54

Per 25 ft.....$1.23 Per 100 ft.....$4.50

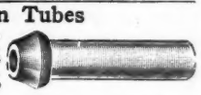
New Code Twisted Pair Cotton Lamp Cord

Two conductor, twisted New Code Lamp Cord. Conductor consist of fine copper wire strands twisted together. Covering is of fine quality interwoven yellow and green cotton. Ship. wt., 6 lbs. per 100 ft. Sold only in lengths listed.

63S3175—Size 18. Price for 10 ft.....28c

Per 25 ft.....65c Per 100 ft.....$2.37

Porcelain Tubes



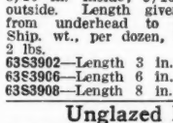
Unglazed Porcelain Tubes, 5/16 in. inside; 9/16 in. outside. Length given is from underhead to end. Ship. wt., per dozen, 1 to 2 lbs.

63S3902—Length 3 in. Per dozen.....$0.22

63S3906—Length 6 in. Per dozen..... .43

63S3908—Length 8 in. Per dozen..... .70

Unglazed Porcelain Cleats



Take No. 10 or smaller wires. Have 2½ in. wire centers. Ship. wt. per dozen pair, 3 lbs.

63S3923—2 wire cleats. Price per dozen 42c

Solid Porcelain Knobs

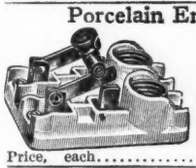
New Code No. 5½ solid porcelain knob. Height, 1-9/16 in. Diam., 1⅛ in. Hole, ¼ in. Groove, 5/16 in. Ship. wt., per doz., 1½ lbs.

63S3927—Per doz. 32c

No. 4 solid porcelain Knob. Height, 1-11/16 in. Diam., 1½ in. Hole, ⅜ in. Groove, ⅜ in. Ship. wt., per doz., 2 lbs.

63S3929—Per doz.....45c

Porcelain Entrance Switch



National Electric Code Standard Porcelain Base Entrance Switch or main line cut-out switch. Takes plug fuses. Capacity, 125 volt, 30-amperes.

63S4305—Two-pole switch. Ship. wt., 1½ lbs. Base size, 3¼x5¼ in.

Price, each.....76c

Antenna and Copper Wire

Supplied only in size coils listed.

63S5150—Aerial cable. Composed of seven strands No. 22 B. & S. gauge hard drawn tinned copper wire. Ship. wt., 6 lbs. per 100 feet.

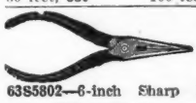
50 feet, 49c 100 feet, 85c 500 feet, $3.95

63S5151—Bare copper wire No. 14 gauge.

50 feet, 22c 100 feet, 42c 500 feet, $1.70

63S5152—Bare copper wire No. 12 gauge.

50 feet, 33c 100 feet, 62c 500 feet, $2.65



A high grade Hardened Steel Plier. Used a great deal on all electrical work. Handy around any work shop. Ship. weight, 6 oz.

63S5802—6-inch Sharp Nose Plier. Price each..... $1.23

Best Hardened Tool Steel Diagonal Jaw Side-cutting Nipper. Length, 5 in. Ship. wt., 4 oz.

63S5808—Diagonal Jaw Pliers. Price. $1.28

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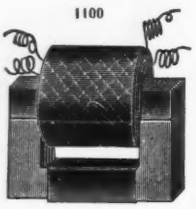
"RASCO HAS IT!"

THE Radio Specialty Co.--*"Rasco"* for short—is probably the most unique supply house in the United States, if not in the world to-day. This company makes a specialty of small orders, no order being too small to get immediate and prompt attention for the simple reason that most of our orders are small.

The reputation of this house was built upon service. Ask any of your acquaintances what they think of *Rasco* goods, *Rasco* service, *Rasco* promptness! Thousands of unsolicited testimonials on file to prove that we serve the public best!

Be sure to get our great catalogue, containing several hundred different parts, which is illustrated below.

ORDER DIRECT FROM THIS PAGE. ALL GOODS SENT PREPAID IN 24 HOURS



1100

"RASCO" AUDIO FREQUENCY TRANSFORMER

We have compared many of the present transformers on the market but have finally decided upon a type that is the most efficient one we have seen so far. The best amplifying transformer is that in which the impedance of its primary is equal to or exceeds the impedance of the plate-to-filament circuit of the tube in which it is connected.

We guarantee this transformer to equal any one on the market.

No. 1100 "Rasco" Audio Frequency Transformer **(not assembled) each prepaid**.....$2.65

ANTENNA CONNECTOR

This antenna connector is made entirely of aluminum, is light and will not rust. The only connector of its kind. The 4 antenna wires go to the upper holes; the lower hole takes the lead-in. Don't solder your aerial, don't have loose connections. Dimensions 2" high, 1¾" wide, ⅝" thick.

No. 999, Connector, each..$0.35

999

PANEL KNOBS

6241

838

No. 6241 is well made and has a good corrugation. Its dia. is 1", height is ½", hole 5/32". The shank is ¼" high.

No. 6241, Knob, each.....$0.08

MARCONI KNOB

Has a central hole of 5/32" and seat to hold the screw, dia. is 1¼", height ¾".

No. 838, Marconi Knob, each.....$0.15

RASCO POSTS

202 201

630 029

These are our very own patterns, from our own designs and look mighty handsome on any instrument. The top knobs are of composition, the bottom parts brass nickel plated polish.

No. 202 is nickel plated at bottom part.

"Rasco" Binding Post, 8/32 thread, each, $0.10; doz., $1.00.

No. 202, Post, each, ...$0.08

Nos. 650 and **651** made entirely in composition with a hexagonal brass nut in center.

No. 650 has 8/32 machine screw.

No. 651 has bottom wood screw.

No. 650, Post, each.....$0.08

No. 651, Post, each.....$0.08

Dozen, each style.....$0.90

650 651

BRASS NICKEL POSTS

No. 029, Binding Post, each.....$0.05

No. 030, Binding Post, each.....$0.04

RASCO SWITCH POINTS

75 1 2 3 4 5 6 7 77 76

Nickel plated and polished. The following have been found the most popular.

No. 1 ¼"x¼", 6/32 thread, ea., $0.03; doz., 35c

No. 2, 3/16" high, ¼" dia., 6/32 thread, ea., $0.03; doz., 35c.

No. 3, 3/16" x 3/16", 4-36 thread, ea., $0.03; doz. 35c.

No. 4, ¼" dia.; ⅛" thick; stem 6/32, ea., $0.03½; doz., 40c.

No. 5, ¼" dia. 3/16" thick; stem 4-36, ea., $0.03½; doz., 40c

No. 6, 3/16" dia.; 3/16" thick; stem 4-36, ea., $0.03½; doz., 40c.

No. 7, 3/16" dia.; ⅛" thick; stem 4-36, ea., $0.03½; doz., 40c.

No. 75, Switch Stop, ⅞" long, 4-36 thread, complete with nut, ea., $0.05; doz., 50c.

No. 76, New style Switch Point, to be pressed into bakelite panels with forced fit. Wire is soldered to pin end. Head ¼"; dia., 1/16" thick, ea., $0.03½; doz., 40c.

No. 77, same as above, but head is ¼" dia. x 3/16" thick, ea., $0.03½, doz., 40c.

THE RASCO BABY DETECTOR

1898

In presenting this little Detector, we feel sure that it fills a place never taken before by any small detector. It does a variety of things and does them all well and better than many $5.00 detectors. The base is solid, black composition. Mounted on same is a nickel holder and binding post which holds a fluted hard rubber knob with its sliding rod member.

The outstanding part of the Detector, is the patented nickel detector cup and binding post. The knurled cup unscrews and you place the Galena Crystal in the cup, then replace the knurled cap and the galena crystal is held secure. The circular hole in the cap exposes enough of the crystal for ordinary purposes.

No. 1898, Rasco Baby Galena Detector. Price, prepaid.....$0.50

No. 1899, Rasco Baby Detector with Galena and Radiocite Crystals. Price, prepaid.....$0.75

PANEL SWITCH LEVER

New style switch lever with lock fork. It is impossible for this lever not to make positive contact at all times. The blade radius is 1¼". Blade is nickel plated and polished. Fork is phosphor bronze. The lock fork holds the screw (in which it rotates), securely. A loose contact is impossible.

200

No. 200, Switch Lever, complete as illustrated..$0.30

LITZ WIRE

323

This wire is recognized as the only thing for winding coils for Radio instruments. Particularly recommended with our **No. 343** Variocoupler Rotor, for vario-couplers, banked windings, etc.

No. 323, Litz Wire, 20 No. 38 strands, enameled double silk wire, per foot, $0.02; per 100 feet, $1.15

No. 890, Litz Wire, 10 strands No. 38 wire, per foot, $0.01; per 100 feet, $0.75.

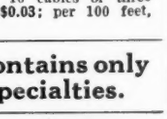
No. 891, Litz Wire, 16 cables of three strands No. 38 wire, per foot, $0.03; per 100 feet, $2.25.

NOTE: This page contains only a few of our 300 specialties.

PANEL KNOB

This is a very distinctive knob and can be used on dials, panels, switches, condensers, etc. It is exceptional and well made. Dia. 1 1/16"; height 11/16"; comes with 8/32" bushing.

No. 815, Knob, each.....$0.18



815

VARIOCOUPLER ROTOR

343

This rotor is used by all up-to-date amateurs. Is accurately turned of hard wood and is used as a secondary coil. It takes any finish, either shellac or stain and can be drilled readily for any size hole. Large hole 2" dia. Width of spool is 2". Total dia. 3⅜".

No. 343 Variocoupler Rotor, each $0.75

827

"RASCO" NAME PLATES

839

Our name plates are of brass with a black background. Letters are polished nickel. Order by name and number.

	Each		Each
807 "Phones"	$0.05	810 "Ground	$0.05
809 "Aerial"	$0.05	812 "Primary"	$0.05
811 "Secondary"	$0.05	814 "Detector"	$0.05
813 "Audion"	$0.05	866 "On"	$0.05
865 "Off"	$0.05	840 "Increase Current" (Right)	$0.10
839 "Increase Current (Right)	$0.10	834 "Series"	$0.05
813 "Vacuum Tube"	$0.05	830 "Receive"	$0.05
831 "Transmit	$0.05	820 "2nd Step"	$0.05
821 "3rd Step"	$0.0	827 "Tickler"	$0.05
819 "1st Step"	$0.05	825 "Plate Variometer"	$0.05
826 "Grid Variometer"	0.05	835 "B Battery"	$0.05
823 "Secondary"	$0.05	817 "Output"	$0.05
836 "A Battery"	$0.05	824 "Primary Condenser"	$0.05
818 "Input"	$0.05	828 "Parallel"	$0.05
829 "Telephone"	$0.05	837 "+ —"	$0.05
833 "Detector Tube"	$0.0	841 "(Blank) "(takes pen or pencil writing)	$0.05
822 "Coupling"	$0.0		
808 "Load'g Coil	$0.0		

Price of all of our name plates in dozen lots, 50c, with the exception of the two "Increase Current"

BAKELITE PANELS

350-55

We list below six panels, the sizes of which have been selected after carefully checking up many dimensions of the most popular radio apparatus on the market.

Note particularly that our prices are anywhere from 25 to 50% lower than those quoted by most other concerns. The reason is that we buy these panels in very large quantities, **and we do not cut sheets to order.** Remember always that when sheets are cut to order they cost you at least 50% more than our prices, because **you must pay for the cutting and the necessary waste.**

Note also that we ship these panels prepaid. This alone amounts to a considerable saving.

No. 350	6"	x 12"	x 3/16"	thick,	each	$1.90
No. 351	6"	x 18"	x 3/16"	"	"	2.85
No. 352	9"	x 12"	x 3/16"	"	"	3.00
No. 353	12"	x 18"	x 3/16"	"	"	5.65
No. 354	6½"	x 19½"	x 3/16"	"	"	3.50
No. 355	6"	x 7½"	x 3/16"	"	"	1.20

"RASCO" LUBRICATED PANEL SWITCH

A radio switch that has two nuts at the end is a monstrosity, for the reason that it will never stay put. Our patent spring fork holds the switch handle always under uniform tension, at the same time it insures the best contact possible. **New wiping contact**, which covers every point of the switch point. Another new improvement is the lock fork, which can assume three different positions to accommodate the switch to various thicknesses of panels.

1921

No. 1921 "Rasco" Switch, as illustrated, each $0.50.

KNOBS

199

4451

These knobs are favorites with all experimenters The size of both is: dia. 1⅛", height ⅝". No. 4451 comes with 8/32 and 10/32 bushing.

No. 4451, Knob, each...$0.06

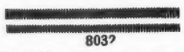
No. 199 (screw length ⅝") Knob, each $0.10

NAVY KEY KNOB

This navy key knob is now used on all standard wireless keys. It gives the right swinging mation and rests the fingers. It is a favorite with all advanced amateurs. Once used always used. The screw is 8/32 and will fit all keys.

748

No. 748, Key Knob, each.....$0.28



8032

THREADED BRASS ROD

We carry two styles, 6/32 and 8/32 thread. **Only 6" lengths sold. No others.**

No. 8032, Threaded Brass Rod 8/32 thread, per 6" length $0.08

No. 6032, Threaded Brass Rod, 6/32 thread, per 6" length $0.06

THE "RASCO" CATALOG

CONTAINS 50 VACUUM TUBE HOOK-UPS

Complete hook-ups of all important vacuum tube circuits are given in clear diagrams with complete explanation. Just to name a few. —The V.T. as a detector and one-step amplifier; regenerative circuit; De Forest ultraudion; V.T. to receive undamped and spark signals; Armstrong circuits; one step radio frequency amplifier and detector; three stage audio-frequency amplifier; short wave regenerative circuits; V.T. radio telephone; 4-stage radio frequency amplifiers; radio and audio frequency amplifier, inductively coupled amplifier; Armstrong superautodyne; radio frequency amplifier and crystal detector; etc., etc. The catalog contains 200 illustrations. On account of its great cost, it cannot be distributed free of charge. Mailed only upon receipt of

The catalog contains 200 illustrations. On account of its great cost, it cannot be distributed free of charge. Mailed only upon receipt of

15c in stamps or coin.

Radio Specialty Co.

This business was originated with the sole purpose to cater to the amateur who has small orders. ALL OF OUR ORDERS ARE SMALL and that is why your small order will never be sidetracked by us. A trial order will make you a life customer. Order from the above illustrations. "We can only stick you once." Try us with a 50c order. ALL GOODS PREPAID.

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RADIO NEWS

H. GERNSBACK—Editor
ROBERT E. LACAULT—Associate Editor

Vol. 3 JANUARY, 1922 No. 7

RADIO 1921-1922

THE year 1921, just closed, was not a prolific one, as far as great inventions in radio are concerned. As a matter of fact, the reviewer would be hard put to pick out any radio invention of note made during 1921. To be sure, there have been many new inventions, and the year 1921 was not a poor one, if we consider the inventions actually made. As a matter of fact, there were almost three times as many radio patents issued by our Patent Office in 1921 as in 1920. Most of these patents, however, were improvements, few basic inventions being numbered among them.

This, however, does not mean that the art was retarded. Quite the contrary. It seems that 1921 will go down in radio history as the birth of the radio telephone, as far as its universal adoption, and its cognizance by the public are concerned. An art may be said to have "arrived" when it becomes universally known, and when the public begins to use it one way or another.

Thus the electric trolley car was known thoroughly for over 20 years before it came into universal use. The automobile, too, was well known for 25 years or more, before the public began buying it. The telephone invented in 1876 by Alexander Graham Bell was as good an instrument as we have to-day, and it may be questioned whether the original instrument that Bell made was ever much improved upon. Nevertheless, it took about 20 years before the telephone became a public necessity. The same story is repeated with the radio telephone.

Fessenden and Poulsen actually had a good radio telephone over 15 years ago, and the radio engineers, as well as the radio fraternity knew all about it, but the public refused to be interested until 1921. Thus, history is repeating itself, as usual. If anyone had told Alexander Graham Bell in 1876 that there would be 500,000 telephone instruments used in a single city, namely New York, he, the inventor, would probably have shown great impatience toward such a preposterous prophecy.

It would be foolish for us to guess at the number of radio telephone instruments that will be in use 10 years from now. If we predict that its number will run into the tens of millions for the United States alone, we believe that we are making a conservative statement. The reason is plain. The ordinary telephone serves a business purpose for which toll must be exacted. The radio telephone,—for the receiving part at least—costs not one penny. Once the public thoroughly awakens to the fact that it can hear grand opera, jazz, and news at home, free of charge at almost every hour of the twenty-four during the day, there will be a stampede for instruments unparalleled, not only in the history of radio, but in the telephone business as well.

We will probably not use, in 1922, the radio telephone in the same sense that we use the wire telephone to-day. Probably the radio telephone will never displace the present telephone on account of interference, and if it does finally displace it, it surely will not happen in 1922. Perhaps 10 or 20 years from now, the radio telephone will displace the wire telephone, although even this we doubt very much. But it is not necessary that this should occur, just as the telegraph has not displaced the telephone, nor has radio telegraphy displaced the wire telegraph. Each has a function of its own; each covers its own field of utility.

In 1922, we may safely predict that millions of homes will have their radio receiving stations right in their parlors. The house aerial to a great extent will begin to wane in 1922, and this will be the year of the loop in preference to the outdoor aerial. The "radiotrola" of which we spoke last month, will come into its own. The latter for the time being will eclipse, or put into the shade, its predecessor, the Victrola and the like.

There will be an entirely new industry built right around the radiotrola in 1922, and the writer understands that already one of the largest electrical concerns in the country has started active plans for building these sets in 1922.

The radiophone will come into more general use on the automobile, the motor-boat, the yacht, and the airplane. Indeed, many of the things that were expected to happen "some day" will surely happen in 1922.

Even in France, where amateur radio is just beginning, there is going to be a radio broadcast from the Eiffel Tower, sending out news to all stations within a radius of about 800 miles. The same station will be used as a public radiophone service by Paris and London, so that any subscriber in one of these cities will be able to talk to someone in Paris, or other cities while far out at sea. Thus Marshall Foch and Premier Briand during their return from America talked to the French President while 600 miles at sea. All of these are accomplished facts.

In face of all this, who dares say what the year 1922 will not bring? **We predict for one thing that every manufacturer of radio receiving instruments will be swamped with business beyond his fondest expectations,** and those who read the future as it looks to us had better get an early start to keep up with the radio boom toward which we are surely headed.

H. GERNSBACK.

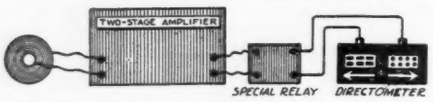
Radio Comes to the Aid of the Autoist

Radio device makes highway travel safe and fast

By RAYMOND FRANCIS YATES

The Same as a Ship May be Guided into Port by the Guide Cable, An Automobile on the Road May be Directed by Means of the "Directometer." A Line in Which Flows a 500 Cycle Current is Installed Along the Road Inducing Into a Coil Fixed on the Car Sufficient Energy to Operate an Instrument Which Shows the Driver the Correct Way to a Certain Town.

HOW nice it would be to roll along the highways at high speed with a small instrument mounted on the dash of the car that would tell us



This is the Complete Outfit Carried on the Car; it Consists of a Coil of Suitable Design Fixed on the Radiator and the Instruments Shown Are Located at the Most Convenient Place.

in no uncertain terms whether or not we were on the right road? Such a device would indeed save much gnashing of teeth and unwarranted abuse of guide books, road maps, etc. The poor tourist who has once lost his way on a rainy night in a strange country, has some very definite notions as to how roads should be marked. He has at last been provided with an instrument that will more than fulfill his expectations, in fact, it will meet his wildest dreams.

Vacuum tubes come up in the most unexpected places. First they are amplifying the weak galvanic currents produced by heart action, then they help scientists measure distances as small as five-hundred millionths of an inch, and now a use for them has been found in guiding automobilists. A New York inventor has brought forth what will hereafter be known as a Directometer. The Directometer is an almost human instrument which will take its place on the dash with the rest of the indicating devices. Its presence will be an insurance of fast safe travel over any highway. If the driver of the car happens to get on the wrong road by mistake, an alarm bell will promptly ring. If he approaches a detouring point on the highway, a flaming red arrow will appear on the face of the instrument telling him the direction in which he must turn.

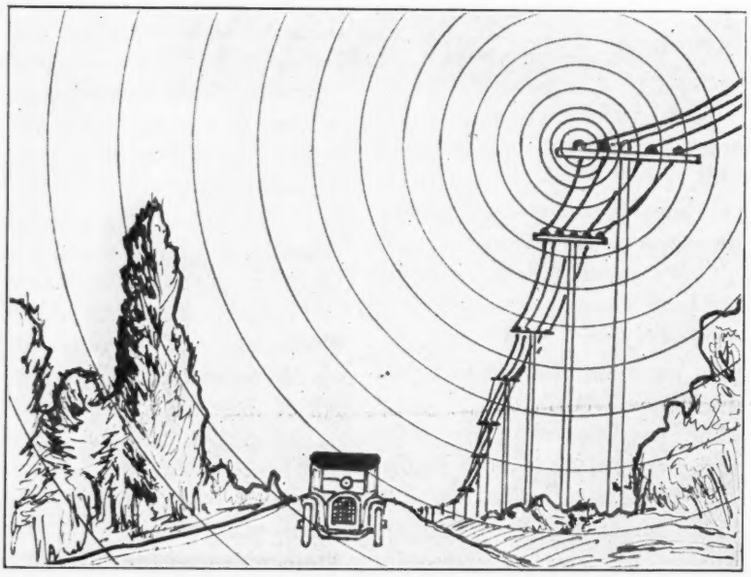
During the war, the vessels of the Allied nations were finding their way into port in the dark of night without guiding bouys and without a light on board. The German submarine commanders were amazed. The ships were guided by a cable laid at the bottom of the harbors. This cable had a high-frequency current surging through it which was broken up into signals. The signals were picked up by the pilot of the ship and maximum loudness told him that he was directly over the cable. In this manner, he was able to following the cable into port.

This particular system was invented and perfected by Mr. Earl Hanson, a radio expert who does not need any introduction to most of the readers of RADIO NEWS. Mr. Hanson has been with us since the days of the first tuned sets.

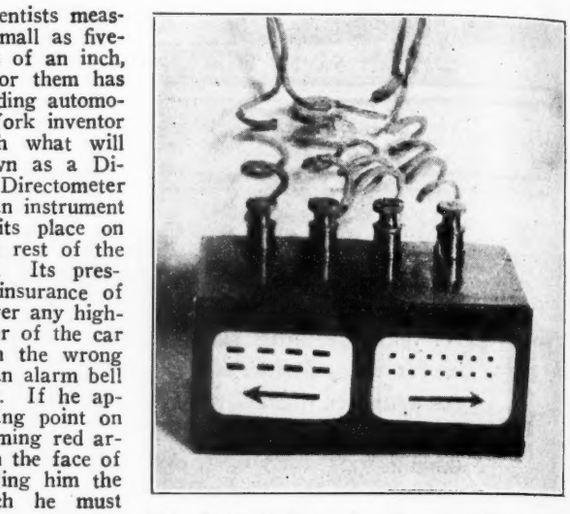
The present inventor has modified the system described above and applied it to automobile travel. The necessity of listening for "maximum loudness" has been eliminated and the signals are registered on the face of the Directometer.

The wire carrying the signals may be placed at the side of the road on existing telegraph poles, or it may be buried under the road bed at the time the road is laid. If it is laid under the road, it is free from the disturbing influences of the weather. A small 500-cycle generator located at one end of this wire causes signals to pass over it at regular intervals. This is done with a mechanical interrupter mounted on the generator and driven by it through a train of gears. The generator and its auxiliary mechanism is small enough to be housed in a weather-proof container no larger than a good sized packing box. With this system, the wire following each highway will carry a definite

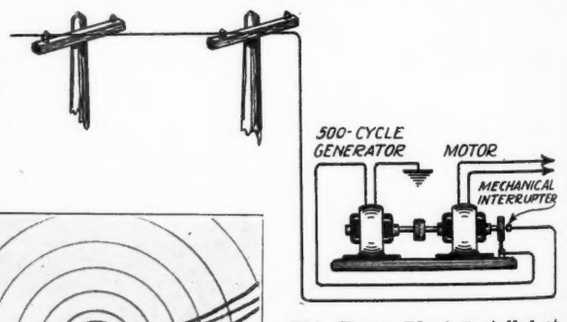
(*Continued on page* 624)



This Sketch Shows How the 500 Cycle Current Flowing in a Line Along the Road, Produces a Magnetic Field, Causing, by Induction, a Current to Flow in a Coil Placed on the Car.



This Small Instrument, When Installed on a Car With the Proper Amplifier, Shows to the Driver Where to Turn at the Crossings of the Road, a Luminous Red Arrow and a Bell Calling His Attention. In the Future This Apparatus Will Replace the Maps and Guide Books for the Autoist.

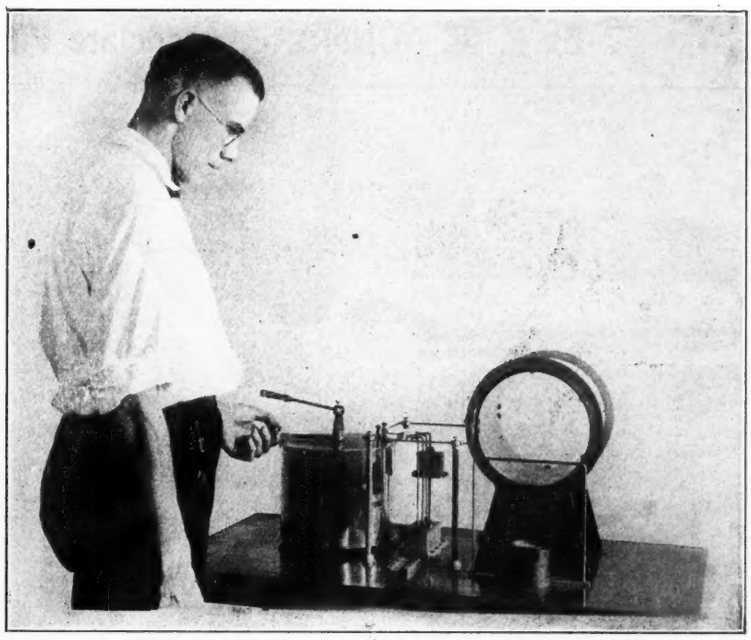


This Power Plant Installed at One End of the Line Sends Some Combinations of Dots and Dashes, Thanks to a Mechanical interrupter. A Combination May be Used for Each Road.

The New Wavemeter of the Bureau of Standards

By S. R. WINTERS

CAPABLE of measuring wave-lengths ranging from 65 to 85,000 meters, or when expressed in terms of frequency from 3,500 to 4,600,000 cycles a second, a standard wavemeter has been developed by R. C. Cox of the Radio Communicaton Section of the National Bureau of Standards. The insistent needs of Government, commercial, and university laboratories for apparatus with a capacity for correctly determining the frequency of rapidly alternating currents are satisfied in the instrument about to be described.



The wavemeter here pictured was recently built in the Bureau of Standards and is the most perfect instrument of this kind ever made. It can measure any wave-length from 65 to 85,000 meters with perfect accuracy.

The variable condenser, although in principle adhering to a type previously designed by the Bureau of Standards, has been modified to serve the specific object outlined. A metal top in its entirety has displaced one heretofore composed of both an insulating substance and metal. This covering is nickel-plated and finished with a color of dull appearance. The eyes of the operator are thus not subjected to the glare of a bright surface, and likewise the pride of sightliness is better served. The handle proper of the condenser has been lengthened, while that portion of it subject to insulation has been abbreviated. The handle axis is gripped by a vertical screw by which the axis can be clamped to the condenser shaft or released and rotated readily, as needs may dictate. This arrangement is a sort of leverage on the handle to forestall its obstruction of the view of the observer's scale, or forbid entrance in the field of the wavemeter leads. The vertical screw involves the use of considerable force to clamp and release, but is devoid of the tendency of a horizontal screw to toss or jerk the handle.

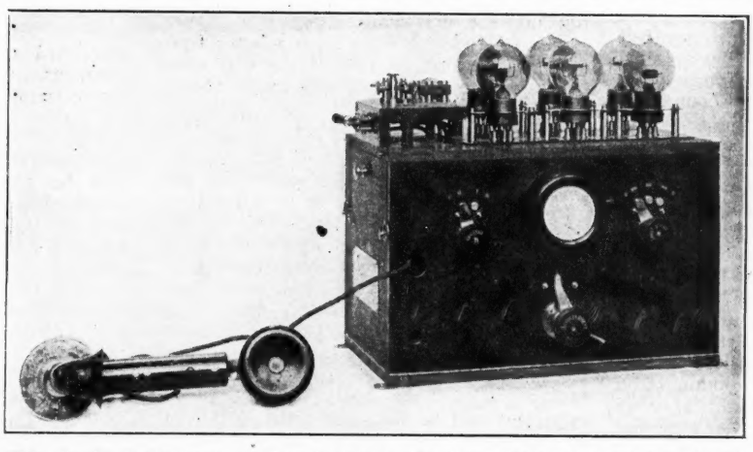
The scale of this variable condenser is graduated to finer degrees than that of the conventional condenser of the Radio Communication Section of the Bureau of Standards. The graduations continue to 190 degrees, a provision enabling the vernier to operate over the range between 171 and 180 degrees. The vernier or contrivance for measuring small intervals is engraved on a block, beveled down, to avoid parallax—an apparent change in the position of an object produced by a shifting of the position of the observer. This block extends to the rear of the device in a flat spring, by means of which it is securely fastened to the condenser top. The beveled edge barely rests on the condenser scale. The marking numerals 0, 5 and 10 on the vernier are extended, resolving themselves into additonal numbers. An extra division is laid off on either side of the 0 and 10 marks as a guide in reading fractions of 0.1 and 0.9 degrees. This provision, however, is deemed of doubtful value because of the difficulty in reading and the possibility of errors to the extent of one degree. A reading glass facilitates the making of observations on the scale. The engraving of the scale and vernier was a contribution of the United States Naval Observatory.

A snail-like mechanism has been affixed to the condenser. An arm, reaching from the rim to the center of the condenser top, is pierced to encircle the condenser shaft. It is clamped to the latter by a long screw. The arm and condenser shaft, when so joined in intimate companionship, can be rotated through a limited area by a screw at the rim of the condenser top. The bearings of the condenser, formerly composed of steel on brass lubricated with oil, have been modified to the extent of consisting of steel on phosphor-bronze, lubricated with powdered graphite. The slow-moving device, comparable to a snail or tortoise, serves well the desired end of tightening the bearings, thus eliminating any vertical play detected in the movement of the condenser shaft. This modified variable condenser shares with other condensers developed by the Bureau of Standards certain outstand-

(*Continued on page* 666)

A New French Portable Radiophone Set

SHOWN in the photograph is a new radiophone and C.W. set which has recently been designed by a French radio company. This instrument, formerly made for use aboard airplanes, has also been tried on automobiles and has given very good results on a very short antenna, enabling the passengers of the car to keep in touch with different stations while the car was in motion. The day range of this compact transmitter when used aboard airplanes, is about 175 miles, with the 35 watts of power obtainable.



This Small Radiophone. C.W and I.C.W. Set Was Designed for Use Aboard Airplanes and is Extremely Compact. The Necessary Adjustments Being Reduced to a Minimum; it May be Operated by the Pilot Himself. Installed on an Automobile This Set Has Proved to be Very Efficient with a Very Small Aerial and the Chassis of the Car as a Counterpoise.

The apparatus is equipped with six tubes, one of which is used as a master oscillator, the other ones being power amplifiers. A buzzer, which may be seen on the left of the tubes, and run by the filament current, acts as a chopper for I.C.W. transmission. By means of a switch, a microphone and modulation transformer may be inserted in the circuit for radiophone work. or cut entirely for straight C.W.

The source of power is a small dynamo with two commutators furnishing on one side six volts for the filaments, and on the other, 700 volts for the plate circuit. The receiving set used in conjunction with this transmitter is a regenerative set of standard type with a two-step amplifier, which can tune any wave-lengths from 300 to 1,000 meters.

Such a station installed on a liner has given clear radiophone communication 300 miles away; on small ships, a range of over 150 miles has been obtained.

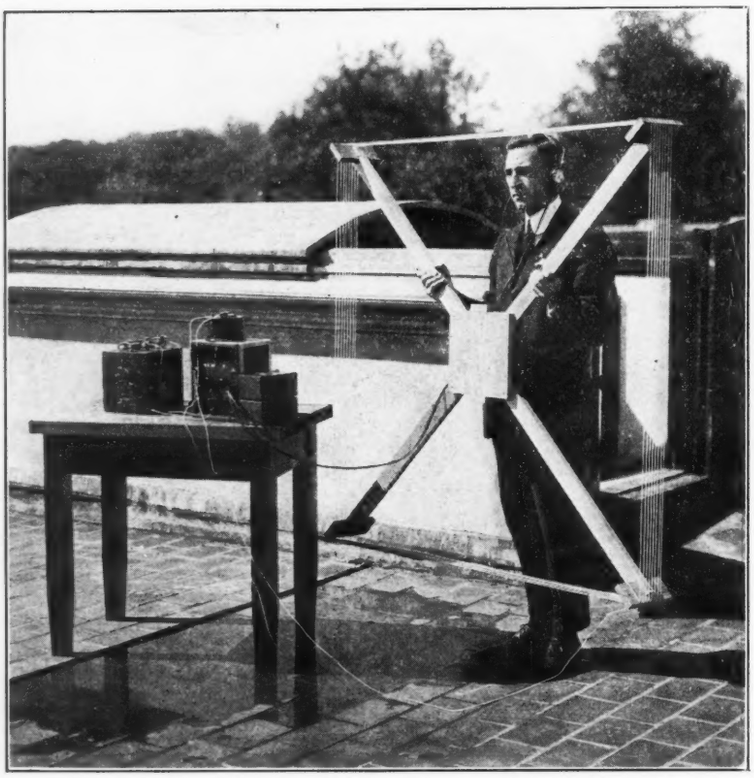
In order to make this set fool proof, and as simple as possible to operate, the necessary adjustments have been reduced to a minimum, so that operators with very little C.W. knowledge, pilots of airplanes, or mates aboard small ships can use this transmitter without any trouble. On the face of the sending set are mounted three switches and the hot wire ammeter connected in the aerial cir-

(*Continued on page* 668)

The Radio Direction Finder

(Its Application, Construction and Operation)

By F. W. DUNMORE, Associate Physicist Bureau of Standards



This portable direction finder may be built by the operators aboard ships and will prove extremely useful in case of fog or to locate a ship in distress. In this very interesting article the author gives complete data for the construction of a loop of the proper size.

APPLICATION IN MARINE DISASTERS

At about 9:15 P. M. on the night of August 6th the steamship *Alaska*, from Portland to San Francisco, carrying 136 passengers and a crew of 84, struck Blunt's Reef, off Cape Mendocino in northern California, in a heavy fog, and sank in about thirty minutes. Throughout this time the *Alaska* sent out distress signals, and the steamship *Anyox* reached the scene of the wreck from a distance of about ten miles at about 11:15 P. M., and with the assistance of other boats which came later, rescued many persons. Forty-two lives were lost. The *Anyox* had a barge in tow which made it extremely difficult for her to stop or start or manœuvre around in the fog. The steamship *Wahkeena* was only about fourteen miles from the *Alaska* at the time that the first distress signal was transmitted, and responded promptly, but did not reach the scene of the disaster until 7:30 A. M. the next morning. For two hours prior to the grounding of the *Alaska*, its radio operator had been trying to obtain radio bearings by transmitting to the radio compass station on shore, at Eureka, Cal., but had been unable to get in communication with that station. The failure to obtain radio bearings was due in part to the fact that a large number of ships were endeavoring to obtain radio bearings at the same time. The *Wahkeena* did not rescue any persons. Neither the *Alaska* nor the *Wahkeena* was equipped with a radio compass.

If the steamship *Alaska* had been provided with a radio compass and radio beacon transmitting stations had been established on shore, the radio operator on the *Alaska* could have determined her position at frequent intervals, and the wreck would probably never have occurred. If the *Anyox* had been provided with a simple radio compass it could probably have reached the *Alaska* before it sank, instead of requiring two hours. If the *Wahkeena* had been equipped with a very simple type of radio compass, her radio operator could have very promptly determineed the direction of the *Alaska*, so that the *Wahkeena* could have reached the *Alaska* in about an hour. The installation of radio compass equipment could thus have in all probability saved many lives, and valuable property. The provision of radio compass equipment on board ship is obviously of particular importance in cases in which there are uncharted currents, since in such cases the setting of a course by dead reckoning in a fog may be disastrous.

The following extract from a letter from a radio operator on the *Alaska* will serve to emphasize the statements made above:

Mr. J. F. DILLON,
Radio Inspector,
San Francisco, Calif.

Strongest in my mind remains the picture of the *Wahkeena*, 12 or 15 miles from us at 9:15 P. M., and after that trying unsuccessfully all night to locate us, while many unfortunate human lives were clinging to floating wreckage and succumbing slowly to exposure. I believe many lives could have been saved if sea-going vessels were equipped with even a simple device for finding the location of other vessels by radio signals. It has been proved that such apparatus can be installed with small cost. It would be still better to have ships equipped with audions or amplifiers.

(Signed) JOHN J. MICHELSON,
Operator, S. S. *Alaska*.

The use of the radio compass to direct assistance to a wrecked ship is probably its most valuable field of usefulness. It has, however, many other applications, some of which are as follows:

1. A neighboring ship may be located in fog and thereby passed in safety.

2. By means of the radio beacon installations now being made on lightships and at lighthouses, a ship equipped with a radio direction finder may be guided safely along the coast or into harbor, during fog.

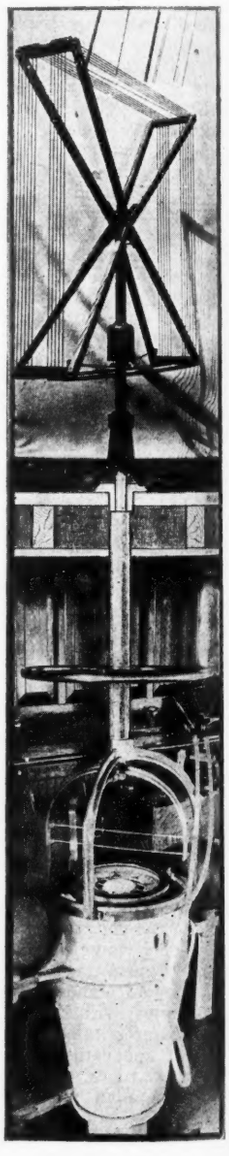
3. Life-boats, adrift in the fog and full of survivors from a wreck, if equipped with even the most simple type of low-powered hand-powered transmitting apparatus could be located and picked up with little delay by the rescuing ship equipped with the radio direction finder. No knowledge of the code is necessary. The importance of the use of the direction finder for this purpose will be apparent when it is realized that many instances have occurred where a life-boat adrift in the fog, in the open ocean, was not located until it was too late to save those aboard, and cases are on record where boats full of survivors were never found.

4. Harbor pilots during fog may locate ships waiting to be piloted into port.

5. Small boats and launches when detached from the mother ship on fishing trip, etc., if equipped with the radio compass, may locate the mother ship and return to her during fog.

6. Radio stations being operated illegally may be located.

7. Interference from one of two interfering stations (if not in line) may be eliminated by setting the direction finder coil on the minimum of the interfering station.



If a permanent installation may be made the arrangement illustrated here is best. The loop is installed outside and mounted on a shaft just above a compass.

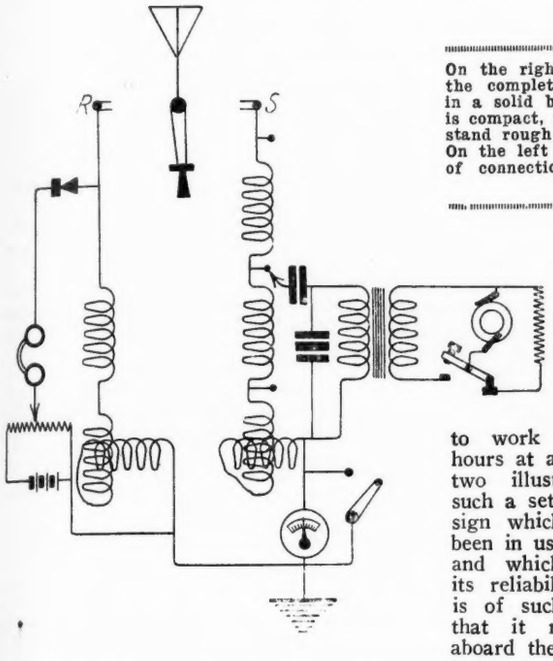
CONSTRUCTION

A simple form of direction finder may be made on shipboard and experimented with by any operator. Having once determined its range and application, it will be found of inestimable value, and an up-to-date addition to any radio station.

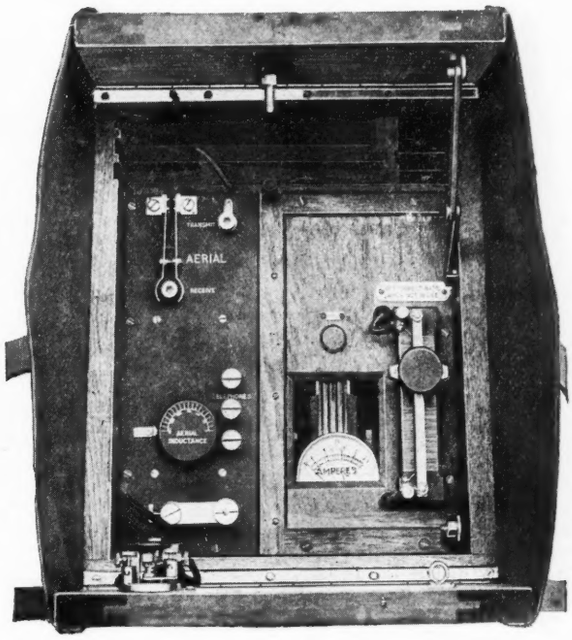
A type most easily constructed consists of two light pieces of wood, 7 feet long, crossed at an angle of 90 degrees, with 6-inch wooden spreaders on the four ends. This frame is wound with eight turns (spaced ½ inch) of No. 20 insulated copper wire, thus forming a square of approximately 5

(*Continued on page 632*)

A New Type of Auxiliary Set for Life Boats



On the right may be seen the complete set installed in a solid box. The outfit is compact, rugged and can stand rough usage.
On the left is the diagram of connections.



IT is well known that in order to insure the safety of the passengers aboard the liners, all the great countries made, in January, 1914, an agreement which compels all the ships carrying a minimum of 50 people, including the crew, to be fitted with the proper radio apparatus. It is stipulated that installation must comprise, first, a station having a range of at least 100 miles, and second, an auxiliary set for emergency, having a range of 50 miles. This emergency set must present all guarantees for efficient service under the worst conditions and must consequently be of rugged and water tight design, being able to stand very rough weather.

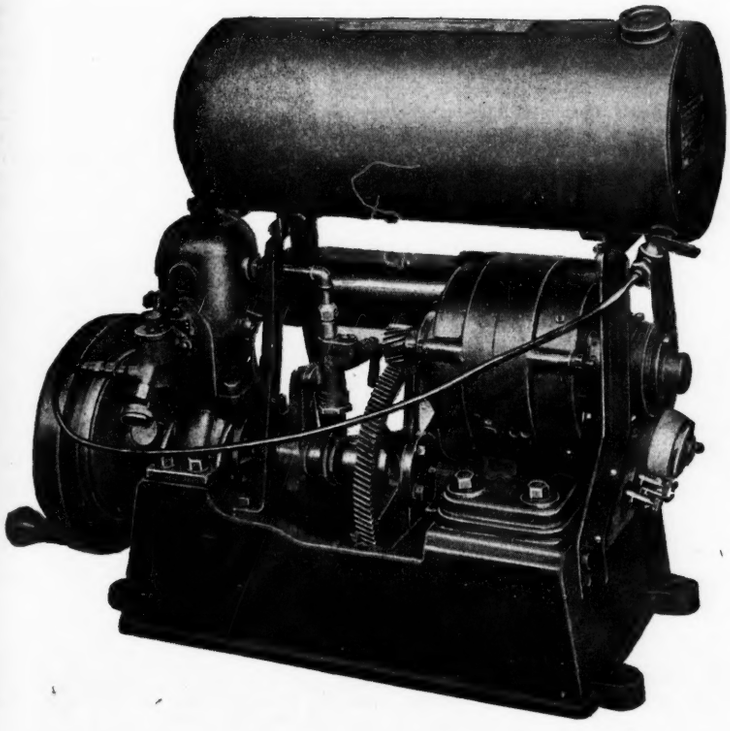
Such sets must be installed on the highest part of the upper deck, must function immediately, in cases of emergency, dispose of a separate source of energy and be able to work at least six hours at a stretch. The two illustrations show such a set of recent design which has already been in use aboard ships and which has proved its reliability. This set is of such compactness that it may be used aboard the life boats, if necessary.

The equipment is fittted with such improvements that it may be instantly in readiness, even after being idle for a very long time and the necessary adjustments have been reduced to a minimum so that the chances of trouble are reduced accordingly. The transmitter and receiver are mounted inside a heavy wooden case made of teak wood which is weather-proof and furthermore is enclosed in a heavy canvas bag; the front panel of the box, which is in two sections, may be opened as shown in Fig. 2, and the lower part supports the sending key, while the upper one, supported by a folding arm, stretches the two sides of the canvas bag, forming a screen around the cabinet, when opened.

The set is adjusted to send and receive on a wave-length of 600 meters and inductances in both sending and receiving circuits are provided for tuning on this wave-length. The transmitting circuit consists of three pancake inductances connected in series, one of which may be displaced, forming a variometer for wave-length adjustments. Between these inductances and the ground connection is inserted another pancake coil, which constitutes the oscillation transformer and is inserted in the oscillating circuits. A hot wire ammeter, which may be short circuited, is connected in the ground lead to ascertain the resonance of the circuits. The spark gap is a quenched gap with mica flanges.

The power is furnished by a small alternator delivering 250 watts at 800 cycles, and may be run either by a gasoline engine, by a D. C. motor supplied by a storage battery, or by the motor of the boat itself. The circuit is so designed that the alternator is constantly loaded; as may be seen in the diagram, it is connected either to the primary of the transformer, or to a shunt resistance through the key.

The receiving circuit consists of a crystal detector, a potentiometer with battery and a pair of phones shunted around a fixed inductance and a variometer, connected in series. A small antenna, which may be erected on the life-boat, is part of the equipment and consists of two wires U shaped, supported by two small folding masts, the total length of this aerial being about 45 ft. The range of this emergency station is slightly over 50 miles, using a crystal receiver; this insures the reception of the signals at such a distance by any ship, even if not equipped with modern apparatus.—*Photo by courtesy of Marconi Co.*



This motor generator furnishes the power to the auxiliary set shown above. It is so designed that it is always ready for use and starts instantly even after a long period of rest or in cold weather.

RADIO TELEPONE FOR COAST GUARDS

During the recent annual meeting of Coast Guard officials at Atlantic City one of the thirty-six-foot motor-driven surf boats that are used for rescue work was sent five miles off shore, and it was demonstrated that men in the boat could easily converse back and forth with the shore station over the radio telephone which had been installed in the boat for the occasion by Bureau of Standards engineers. Not only could the men on shore hear the speaker over the telephone, but also they could hear the boat's whistle and an airplane flying over the boat.

Amateur Long Distance Using Radio Frequency Amplification

By J. M. CHAPPLE

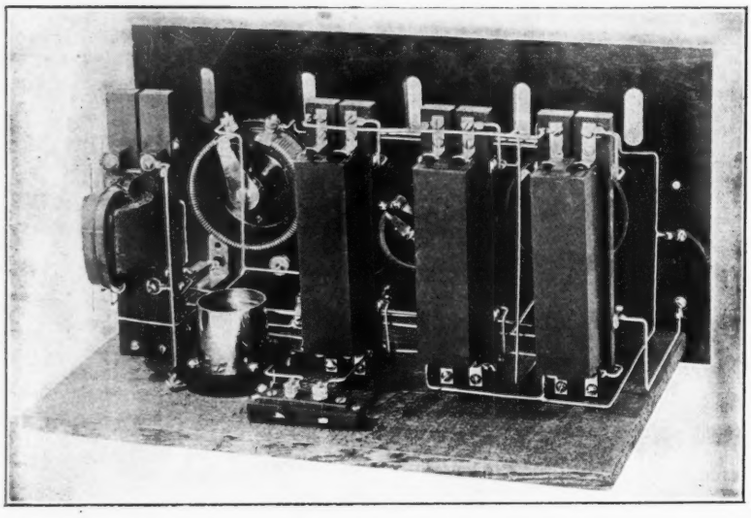


Fig. 4. In this amplifier Myers tubes are used for the three stages of radio and one stage of audio frequency amplification.

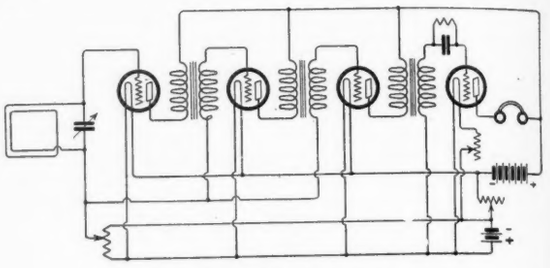


FIG. 2

Fig. 2 Shows the Hook-up of a Three-Stage Radio Frequency Amplifier and Detector.

LONG distance transmission of radio signals at short wave-lengths is dependent mainly on the choice of apparatus in both the transmitter and receiver, if we do not take into consideration the locality in which the station is situated. The design and construction of this apparatus have been given much attention by the amateur in his efforts to cover great distances. Recently, as a result of the development of the vacuum tube transmitter, many amateurs have discarded the spark system, and are now experimenting with continuous wave apparatus. Despite the many advantages of continuous waves, the spark transmitter still has many loyal supporters who feel that there are many possibilities of improvement in damped wave transmission. We must acknowledge that the spark transmitter has undergone remarkable improvement in the last few years, but the Armstrong regenerative receiver has probably increased the range of amateur stations more than anything else. In the reception of long distance signals, the majority of the amateurs consider a variometer tuned regenerative set with a detector and two-stage amplifier as the most efficient arrangement. The two-stage amplifier thus employed, makes use of iron core inter-valve transformers of the audio frequency type. More than two or three stages amplify the induced current from local supply lines, motors and arc lamps to such a volume that signals cannot be read. In addition to the above, a second limitation lies in the necessity of having the incoming signals strong enough to operate the detector. To get proper strength of signals with the above arrangement, the aerial must be high and the receiver highly efficient or else use radio frequency amplification. Without the latter, extremely weak signals will cause no indication in the head telephones.

It has been held by a number of prominent radio engineers that it is practically impossible to amplify incoming radio frequencies above 500,000 cycles by any direct method. Two years ago Armstrong described a receiving system which so amplified the incoming signals that amateur stations were heard over a distance of 1,500 miles, using only a loop aerial. With his method, the incoming high frequencies were heterodyned to a lower frequency, say 50,000 cycles, in order to allow efficient radio frequency amplification, after which they were rectified and then amplified again by two stages of audio frequency. This method has not been extensively used, owing to the expense and also to the multiplicity of controls. Heretofore the reason for failure of radio frequency amplification at short wave-lengths has been the low capacity reactance existing between the elements of the tubes, the effect of the wiring and the capacity effects of the hands or body of the operator.

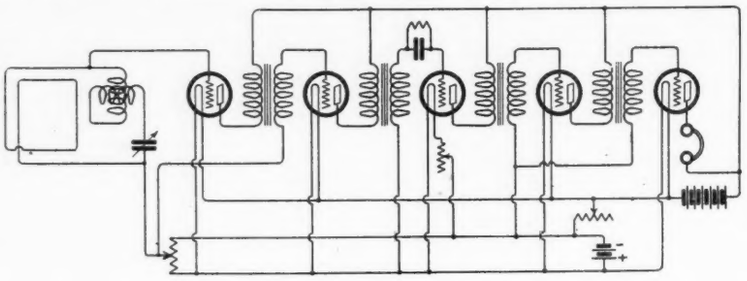


FIG. 1

Diagram of Connections of the Amplifier Shown in Fig. 5 Hooked up to a Loop Aerial.

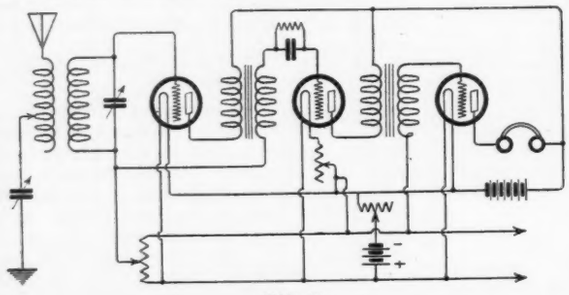


FIG. 3

By Using One Stage of Radio, Detector and One Stage of Audio Frequency Amplification, More Sensibility is Had Than With a Detector and Two-Step Amplifier.

If radio frequency amplification is mentioned to the average amateur, he may discourage further discussion by stating that it is too uncertain in action as well as unstable in operation and that a radio frequency amplifier is too difficult to build or operate. This attitude of mind is gradually disappearing, due to recent developments, as will be evident from the articles and circuits now being published in the radio periodicals.

The main object of this paper is to describe several new features of an amplifier designed by Mr. Brent Daniel, of Washington, D. C., using a new type of radio frequency transformer.

During the development of this amplifier, all known forms of radio frequency amplification were tried out in an effort to determine what particular design or coupling gives the most satisfactory results. After much experimental work, it was learned that a form of laminated iron core transformer was by far the most efficient over a limited range of wave-lengths, for a given transformer. Experimental work was then carried on in an effort to broaden the band of wave-lengths to which the transformer is sensitive. Finally, a design was evolved which not only broadens the band of wave-lengths over which the particular transformer is sensitive, but also increases the efficiency of the amplifier to a marked degree especially at short wave-lengths. Upon testing, short wave signals were received over surprising distances both day and night, using an indoor coil aerial and a simple non-regenerative receiver. A very interesting feature of this amplifier design is that the radio frequency

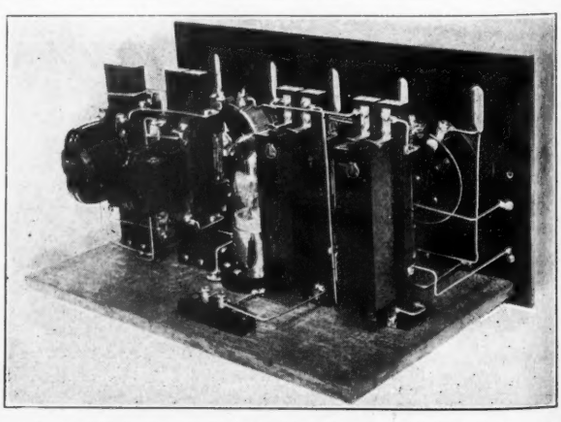


Fig. 5. For All Round Work, Such an Amplifier Having Two Stages of Radio, Detector, and Two Stages of Audio Frequency Amplification is Preferable, as a Loud Talker, May be Efficiently Operated When Inserted in the Plate Circuit of the Last Tube.

circuit used is only a slight modification of the common audio frequency circuit familiar to all amateurs. It is a well-known fact that a radio frequency transformer with an iron core is much more efficient than one with an air core, but heretofore it has been found impossible to obtain any great degree of satisfaction in the use of iron core transformers at short wavelengths, owing to the excessive capacity inherent in the circuits and tubes of the receiver as well as in the transformer itself. The iron core transformer should transfer the energy inductively, rather than waste it by capacity effects and its efficiency is due in great part to the close coupling, impossible by any other method. It is, therefore, self-evident that the use of such transformers in the radio frequency circuit provides a means of amplification superior to any other method, providing the design is such that it will respond well to very high frequencies.

In order to cover a range of 150 to 12,000 meters, four transformers have been designed, each being equipped with a plug-in arrangement allowing instantaneous change from one band of wave-lengths to another.

In Fig. 1 is shown a receiver consisting of a coil aerial, a two-stage radio frequency amplifier, detector and a two-stage audio frequency amplifier. This is a simple affair to the amateur acquainted with radio apparatus, and its construction is not difficult, as all parts can be bought in any radio store. Its operation consists of adjusting two filament rheostats, a potentiometer, a condenser and the variocoupler; practically no more difficult to operate than any modern receiver. Another important feature is the dependability of the set; it will operate without howling or squealing, immediately upon lighting the filaments and adjusting the wave-length setting.

Different methods of using the amplifier are possible, for instance in Fig. 2, we have a coil aerial of any convenient dimension, preferably four feet square or larger, connected to a three-stage radio frequency amplifier and detector. The use of the three stages enables signals to be read, which cannot be heard with the hook-up given in Fig. 1. In Fig. 3, a three-tube receiver having one stage of radio frequency amplification, a detector, and one stage of audio frequency amplification is connected to an ordinary amateur aerial. If a crystal detector is used in connection with radio frequency amplification, the arrangement will give quiet operation and surprisingly efficient reception, in fact a good crystal detector compares very favorably with a "hard" vacuum tube detector.

Radio frequency amplification is manifestly most important for the reception of extremely weak signals. Two or three stages of amplification will bring in distant signals which cannot be heard over the most modern variometer tuned receiver employing only audio frequency transformers.

Radiophone music and speech are reproduced in all their pureness of quality as there is no distortion in amplifying the radio frequency current. An audio frequency transformer cannot be designed with a so-called flat top characteristic for the range of audio frequencies used in radiotelephony, especially when music is transmitted, therefore distortion is often troublesome, especially when high amplification is used.

A receiver such as that shown in Fig. 2 is very effective when used with direction finders or radio compasses. In a direction finder it is advantageous to have the signals as loud as possible in order to find the point of signal extinction more easily. If this point is sharp and well defined good bearings may be obtained. When used with a coil aerial, interference may be reduced by setting the coil on the minimum of the interfering station, thereby leaving the desired signal free to be read. By the use of the coil aerial, the static signal ration is also reduced very noticeably.

Some time ago an invitation was extended to the writer to visit an experimental station in Washington, D. C. At this station a two-stage radio frequency amplifier, detector and two-stage audio frequency amplifier were connected to a vertical single wire aerial, 60′ in length. Signals were received from Chicago stations with such intensity that they could be read at a distance of 20′ from the phones. Dozens of other spark stations were heard with like intensity and signals from stations as far away as New Mexico came in remarkably loud. In this test, the regenerative receiver was not employed, merely a variocoupler, primary series condenser, and secondary condenser as shown in Fig. 3. By using a three-stage radio frequency amplifier on an indoor coil aerial, 10′ square, amateur C.W. and spark stations as far away as Massachusetts, Wisconsin and South Carolina are readily picked up, the signal strength being such as to indicate that greater distances may be covered.

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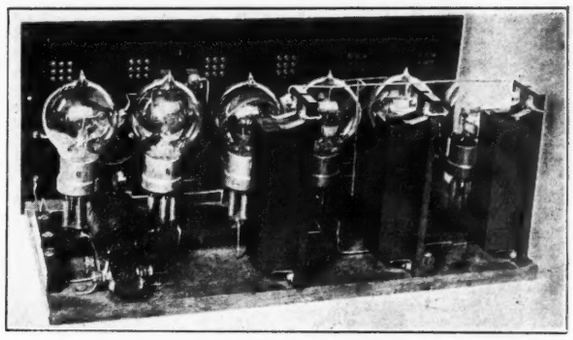

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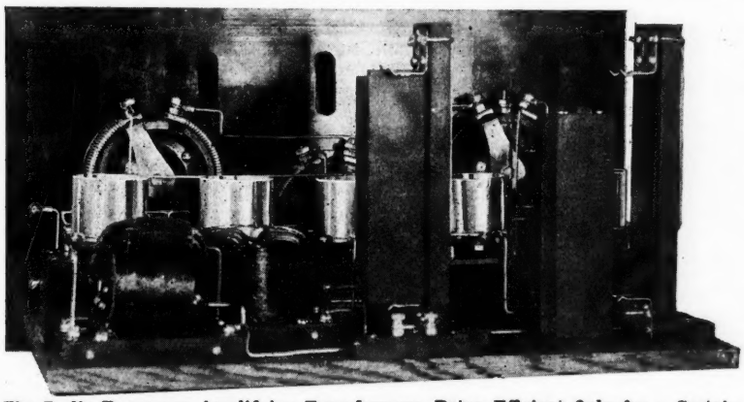

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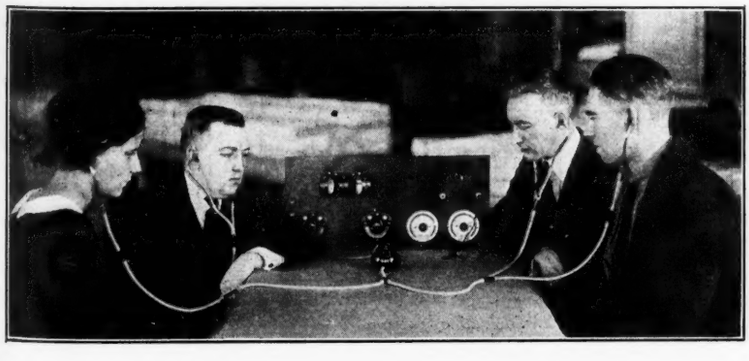

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(*Continued on page 673*)

Amateur Long Distance Using Radio Frequency Amplification

By J. M. CHAPPLE

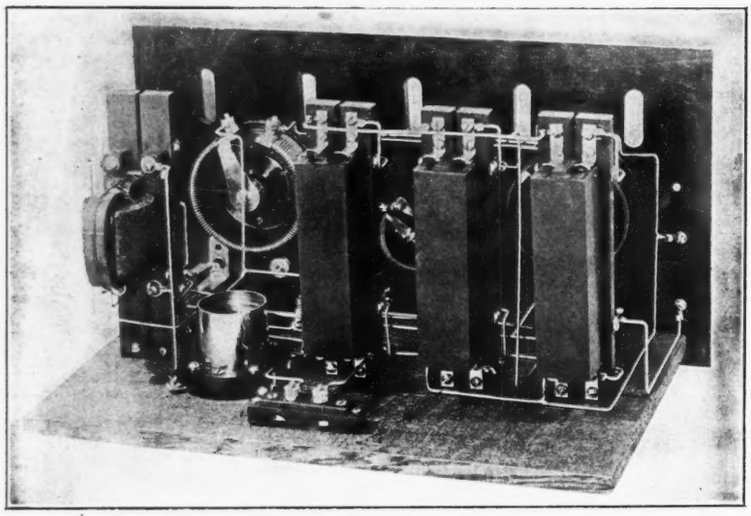

Fig. 4. In this amplifier Myers tubes are used for the three stages of radio and one stage of audio frequency amplification.

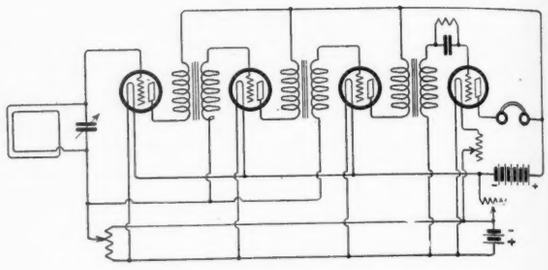

FIG. 2

Fig. 2 Shows the Hook-up of a Three-Stage Radio Frequency Amplifier and Detector.

LONG distance transmission of radio signals at short wave-lengths is dependent mainly on the choice of apparatus in both the transmitter and receiver, if we do not take into consideration the locality in which the station is situated. The design and construction of this apparatus have been given much attention by the amateur in his efforts to cover great distances. Recently, as a result of the development of the vacuum tube transmitter, many amateurs have discarded the spark system, and are now experimenting with continuous wave apparatus. Despite the many advantages of continuous waves, the spark transmitter still has many loyal supporters who feel that there are many possibilities of improvement in damped wave transmission. We must acknowledge that the spark transmitter has undergone remarkable improvement in the last few years, but the Armstrong regenerative receiver has probably increased the range of amateur stations more than anything else. In the reception of long distance signals, the majority of the amateurs consider a variometer tuned regenerative set with a detector and two-stage amplifier as the most efficient arrangement. The two-stage amplifier thus employed, makes use of iron core inter-valve transformers of the audio frequency type. More than two or three stages amplify the induced current from local supply lines, motors and arc lamps to such a volume that signals cannot be read. In addition to the above, a second limitation lies in the necessity of having the incoming signals strong enough to operate the detector. To get proper strength of signals with the above arrangement, the aerial must be high and the receiver highly efficient or else use radio frequency amplification. Without the latter, extremely weak signals will cause no indication in the head telephones.

It has been held by a number of prominent radio engineers that it is practically impossible to amplify incoming radio frequencies above 500,000 cycles by any direct method. Two years ago Armstrong described a receiving system which so amplified the incoming signals that amateur stations were heard over a distance of 1,500 miles, using only a loop aerial. With his method, the incoming high frequencies were heterodyned to a lower frequency, say 50,000 cycles, in order to allow efficient radio frequency amplification, after which they were rectified and then amplified again by two stages of audio frequency. This method has not been extensively used, owing to the expense and also to the multiplicity of controls. Heretofore the reason for failure of radio frequency amplification at short wave-lengths has been the low capacity reactance existing between the elements of the tubes, the effect of the wiring and the capacity effects of the hands or body of the operator.

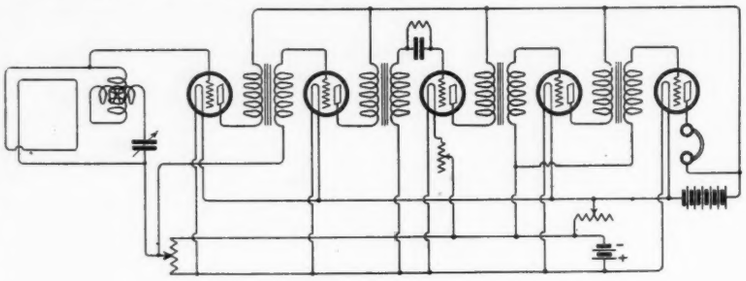

FIG. 1

Diagram of Connections of the Amplifier Shown in Fig. 5 Hooked up to a Loop Aerial.

If radio frequency amplification is mentioned to the average amateur, he may discourage further discussion by stating that it is too uncertain in action as well as unstable in operation and that a radio frequency amplifier is too difficult to build or operate. This attitude of mind is gradually disappearing, due to recent developments, as will be evident from the articles and circuits now being published in the radio periodicals.

The main object of this paper is to describe several new features of an amplifier designed by Mr. Brent Daniel, of Washington, D. C., using a new type of radio frequency transformer.

During the development of this amplifier, all known forms of radio frequency amplification were tried out in an effort to determine what particular design or coupling gives the most satisfactory results. After much experimental work, it was learned that a form of laminated iron core transformer was by far the most efficient over a limited range of wave-lengths, for a given transformer. Experimental work was then carried on in an effort to broaden the band of wave-lengths to which the transformer is sensitive. Finally, a design was evolved which not only broadens the band of wave-lengths over which the particular transformer is sensitive, but also increases the efficiency of the amplifier to a marked degree especially at short wave-lengths. Upon testing, short wave signals were received over surprising distances both day and night, using an indoor coil aerial and a simple non-regenerative receiver. A very interesting feature of this amplifier design is that the radio frequency

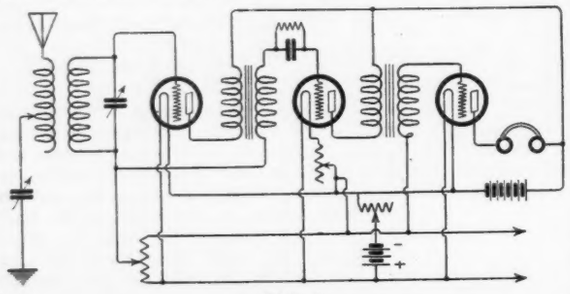

FIG. 3

By Using One Stage of Radio, Detector and One Stage of Audio Frequency Amplification, More Sensibility is Had Than With a Detector and Two-Step Amplifier.

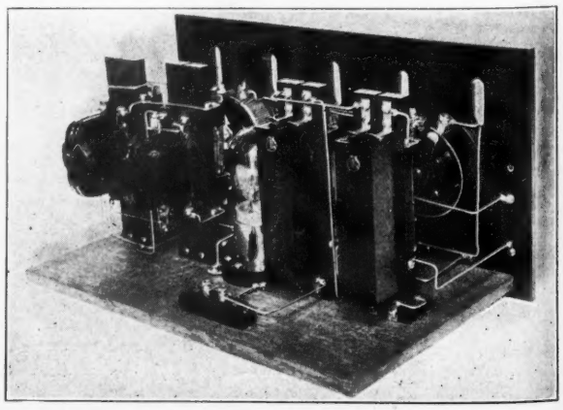

Fig. 5. For All Round Work, Such an Amplifier Having Two Stages of Radio, Detector, and Two Stages of Audio Frequency Amplification is Preferable, as a Loud Talker, May be Efficiently Operated When Inserted in the Plate Circuit of the Last Tube.

circuit used is only a slight modification of the common audio frequency circuit familiar to all amateurs. It is a well-known fact that a radio frequency transformer with an iron core is much more efficient than one with an air core, but heretofore it has been found impossible to obtain any great degree of satisfaction in the use of iron core transformers at short wavelengths, owing to the excessive capacity inherent in the circuits and tubes of the receiver as well as in the transformer itself. The iron core transformer should transfer the energy inductively, rather than waste it by capacity effects and its efficiency is due in great part to the close coupling, impossible by any other method. It is, therefore, self-evident that the use of such transformers in the radio frequency circuit provides a means of amplification superior to any other method, providing the design is such that it will respond well to very high frequencies.

In order to cover a range of 150 to 12,000 meters, four transformers have been designed, each being equipped with a plug-in arrangement allowing instantaneous change from one band of wave-lengths to another.

In Fig. 1 is shown a receiver consisting of a coil aerial, a two-stage radio frequency amplifier, detector and a two-stage audio frequency amplifier. This is a simple affair to the amateur acquainted with radio apparatus, and its construction is not difficult, as all parts can be bought in any radio store. Its operation consists of adjusting two filament rheostats, a potentiometer, a condenser and the variocoupler; practically no more difficult to operate than any modern receiver. Another important feature is the dependability of the set; it will operate without howling or squealing, immediately upon lighting the filaments and adjusting the wave-length setting.

Different methods of using the amplifier are possible, for instance in Fig. 2, we have a coil aerial of any convenient dimension, preferably four feet square or larger, connected to a three-stage radio frequency amplifier and detector. The use of the three stages enables signals to be read, which cannot be heard with the hook-up given in Fig. 1. In Fig. 3, a three-tube receiver having one stage of radio frequency amplification, a detector, and one stage of audio frequency amplification is connected to an ordinary amateur aerial. If a crystal detector is used in connection with radio frequency amplification, the arrangement will give quiet operation and surprisingly efficient reception, in fact a good crystal detector compares very favorably with a "hard" vacuum tube detector.

Radio frequency amplification is manifestly most important for the reception of extremely weak signals. Two or three stages of amplification will bring in distant signals which cannot be heard over the most modern variometer tuned receiver employing only audio frequency transformers.

Radiophone music and speech are reproduced in all their pureness of quality as there is no distortion in amplifying the radio frequency current. An audio frequency transformer cannot be designed with a so-called flat top characteristic for the range of audio frequencies used in radiotelephony, especially when music is transmitted, therefore distortion is often troublesome, especially when high amplification is used.

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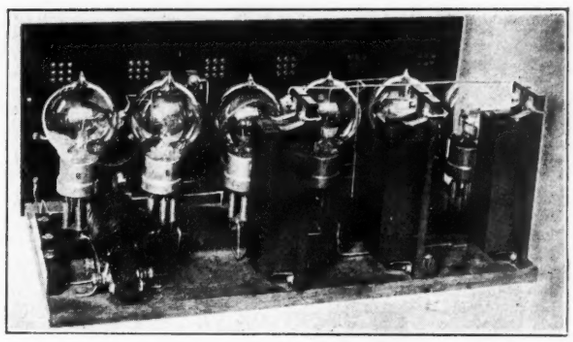

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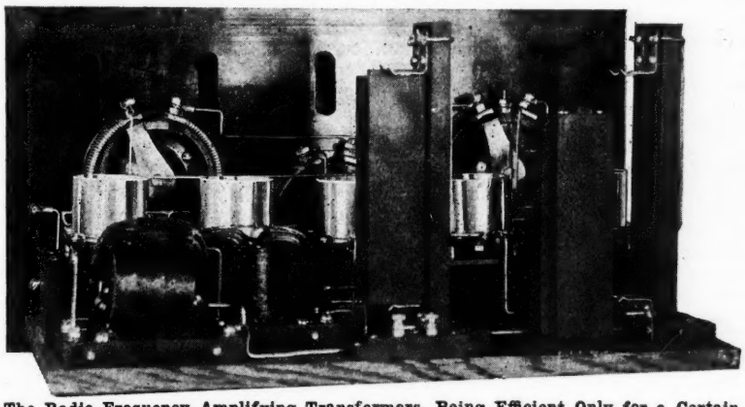

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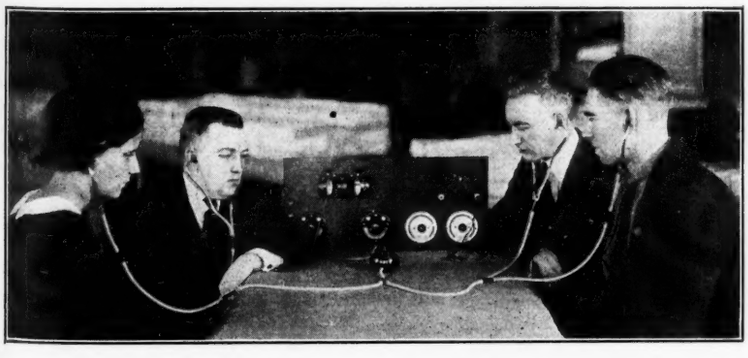

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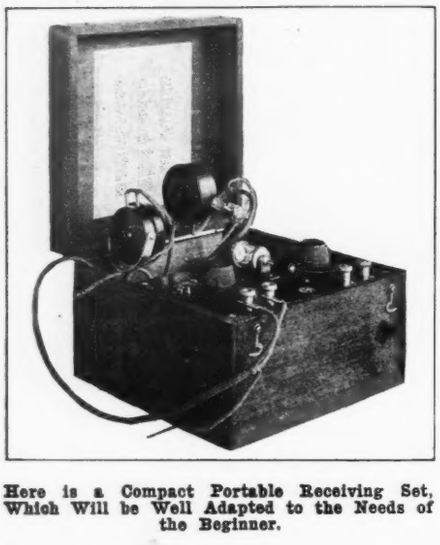
New Receiving Set for the "Fan"

By A. HENRY



Here is a Compact Portable Receiving Set, Which Will be Well Adapted to the Needs of the Beginner.

CHARACTERISTIC of the new era in radio design and manufacture is the receiving outfit here illustrated. It has been designed by a prominent manufacturer of radio apparatus and is acknowledged by capable judges to be as fine a piece of workmanship, for the price at which it is to sell, as has ever made its appearance in radio circles.

The outfit is the result of experiments along the line of developing a simple receiver which would give satisfaction on amateur wave-lengths and still be capable of an electrical range which would include 3,000 meters. Wavemeter measurements of the completed unit, in conjunction with an average antenna, have shown it to be capable of receiving on wave-lengths several hundred meters in excess of its rated range.

Primarily, this outfit has been made to help fill the demand for a receiver which will pick up wireless telephone music. This demand has become so great within the past few weeks that manufacturers maintain it is impossible to fill it. In order that this set will operate satisfactorily on the short waves generally used in wireless telephone broadcasting, the circuit has been designed to give the proper balance to the incoming waves, which it has been claimed does a great deal to insure the best reception of voice and music, without having any deterring of spark signals. With a range which includes 3,000 meters, it will be seen that sight is not lost of the value of having a receiver which will receive the time signals, weather reports and press from the Arlington station, as well as the commercial and government traffic which is carried on on wave-lengths between the upper and lower limits of this set.

This outfit is simplicity itself, for there are but four binding posts and two of these are used for connecting the telephone receivers which come with the outfit. It is, therefore, only necessary for an aerial and ground connection to be made. Ordinarily, a single wire will suffice for the aerial, and the ground connection may be made to a water pipe. There are no batteries to wear out and to be replaced, and given proper care, a set of this character should last a lifetime in operating condition.

The outfit is quite portable, for it weighs but a few pounds and measures little more than 8" x 8" x 6". There is room enough in the compartment for the telephone, to carry enough wire to put up a temporary antenna, which makes it ideal for use in Boy Scout manœuvres, boat trips and so on.

The most sensitive part of the set is the crystal detector, and once this has been properly adjusted it is necessary to make but two adjustments to cover the entire wave-length range. One adjustment is made with a switch, which controls the various bands of working wave-lengths, and the difference between two adjacent points on this switch is taken care of by the second adjustment which is effected by simply turning a dial-knob controlling the position of the rotary plates of the variable condenser to which it is attached. The crystal detector and the two controls may be seen on the outside of the panel.

Back View of the Panel Supporting All the Tuning Device Consisting of a Variable Condenser, a Loading Coil and a Variable Inductance.

The photograph of the interior of the set shows quite clearly the high-class workmanship which characterizes this little outfit. The single-layer inductance is formed by a composition tube, wound with green silk covered copper wire and it is held in place on the lower side of the panel by two brass supports. The lattice-wound coil, in the center of the photo, is held in place by a bracket, also fastened to the panel. The fixed condenser is made of copper and mica and formed between two strips of bakelite held to the front panel by two machine screws, which also serve as terminals. The variable air condenser will be recognized as being of the standard moulded type. Throughout the set, the wiring is guarded by insulating sleeves. The panel is made of bakelite and is engraved as all high-class, present-day apparatus are engraved. It is doubtful that a better piece of radio apparatus could be made and sold at a profit, at the price to be assigned this receiver, when it is put on the market.

Radio Business Is Booming

By ARTHUR H. LYNCH

THE more we cast about in the various industries for information concerning their respective conditions, the more we hear of salesmen returning from road trips after having taken few or no orders, the more we hear of the difficulty which is met in interesting capital in what at other times would be considered very satisfactory investments, just so much the more must we appreciate that radio must indeed be a substantial business, for even in the face of what financiers are wont to call "The Silent Panic" we find radio a bigger, better and infinitely more entertaining game than ever. It has improved in so many ways that it is hard to keep pace with it, but it is still far from the peak of its cycle. There is a very bright future ahead for amateur radio.

The popularity of radio, which has recently increased with leaps and bounds, depends upon several concrete factors not the least of which is amusement. In a great many cases, if not all, we find that the beginner in radio procures his first outfit in order to amuse himself, to find some mental diversion, and somewhere back in his mind is the desire to know something of this wonderful, new science which holds so many fans within its ranks. The time, energy and patience spent with a radio set is rather closely proportional to the amount of fun the set is capable of furnishing. There are as many varieties of fun as there are human beings and in radio we find enough variety to satisfy the whims of the individual; the gamut from the ridiculous little spark coil transmitter to the sublime artists of the Metropolitan Opera sending their music into hundreds of homes by radiotelephony is complete.

ABOUT BUSINESS

Radio business is good! And what is better, it is increasing with gigantic strides. Comparisons are generally odious, but we may best understand the importance of radio by comparing its standing in the commercial world with the standing of other enterprises. Of course there are some dark spots in the radio business, but they are not found generally in the amateur field. Amateur radio is a comparatively new field of endeavor and it would be futile to compare it with such a field as that in which the vacuum cleaner grazes, if we pay attention to size; but when we consider growth, we find radio rapidly romping along to take its place, with a stride so strong that even the "housewife's greatest boon" will find it hard to hold its lead.

Radio of today is somewhat different to what it was even a year ago, for, at that time there were very few wireless telephone stations which amounted to much more than an experiment, while today we find the country pretty well supplied with efficient broadcasting stations, and the immediate future has a great many more within its keeping. This country will be covered with radio music from the Atlantic to the Pacific and the Gulf to the Canadian Border within the next few months.

The demand for radio apparatus is so great that manufacturers are finding it hard to turn out enough apparatus to supply it. There are now about a half dozen different makes of receiving sets, which have been made especially to please the radio fan, who will be satisfied with a moderately priced receiver, with which he may hear concerts by radiophone and time signals and news reports. The sale of such receiving sets has become very great and is continually increasing. These sets have established a new precedent in radio selling, for they have helped to do away with the timeworn

(*Continued on page* 656)

Radio Reception by Means of the Senses of Sight and Touch

By LYNDE FREEMAN

IN Marconi's day when the coherer was used in connection with the de-coherer and a relay, it was possible to receive telegraph messages on the ordinary sounder, by sound. This method was soon superseded by the enormously more sensitive microphone, electrolytic, crystal and valve detectors which employ the very sensitive telephone receiver as the translating device. The telephone receiver, of course, makes the signal audible as characteristic short and long sounds of the pitch corresponding to the sound of the spark at the transmitter.

The idea of touch or sight reception would have seemed absurd to the radio man of yesterday: it may even seem absurd to some today.

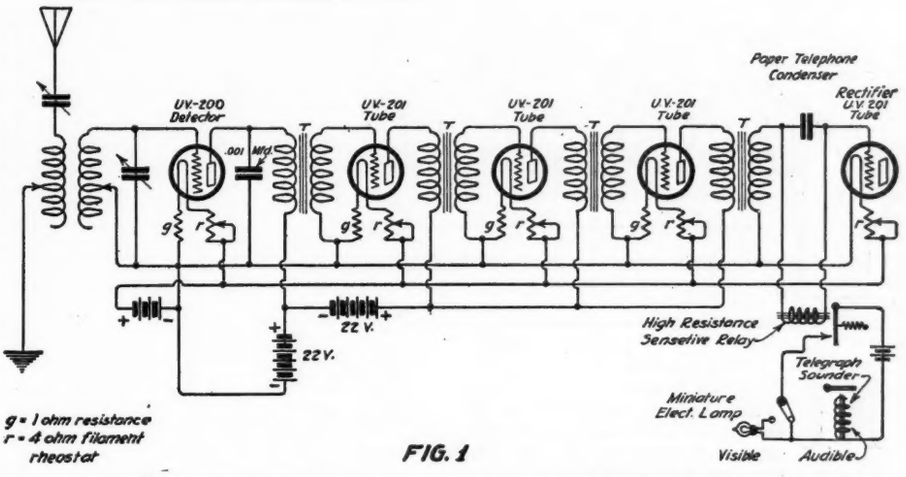


FIG. 1

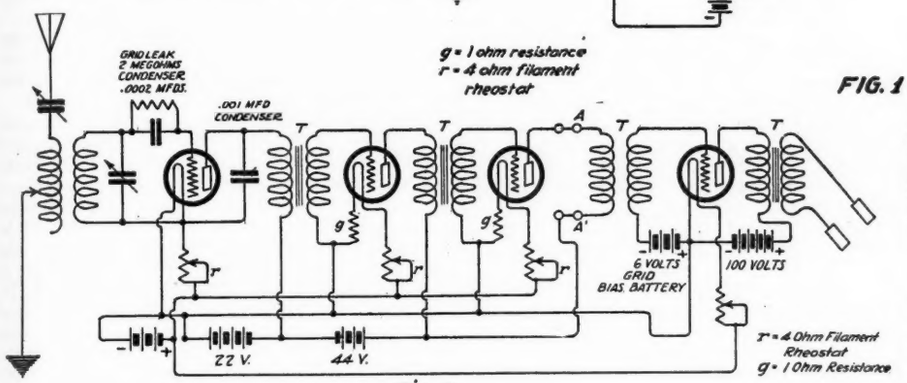


FIG. 2

Fig. 1 is the Hook-up of a Receiver With Detector and Three-Step Amplifier to Which is Connected a Rectifier Operating a Relay. Either a Sounder or a Lamp May be Controlled by This Relay Making the Signals Either Audible or Visible. On the Left, Fig. 2, is a Circuit for Touch Reception. By Touching the Electrodes Connected to the Secondary of the Last Transformer the Signals are Felt.

THE AUDION AMPLIFIER MAKES SIGHT RECEPTION POSSIBLE

The audion amplifier today makes many things possible which heretofore were never even dreamed of. By amplification of the signal by means of an amplifier, two or three stages will be sufficient, there is available at the output something of the order of 1,500 times the voltage or 2,250,000 times the energy applied to its input circuit. These appalling figures explain, in a measure, how the direct current relay can be operated, after the signal has been rectified by the rectifier, from the minute energy received from the antenna. Fig. 1 is a circuit diagram of a detector, amplifier, rectifier and relay. The relay should be wound with a large number of turns in order to operate most efficiently with the audion. This relay can be made to control a small electric lamp, a sounder or other device as shown in Fig. 1. In the case of the electric lamp, the signals will be visual: the dots and dashes will be represented by long and short flashes of the lamp. This is an example of "sight reception."

TOUCH RECEPTION

Touch reception of telegraph signals is also possible, thanks to the audion, by a modification of the scheme used for the sight reception. The circuit shown in Fig. 2 is adapted to touch reception. The signal is detected by the detector and amplified by the three stage amplifier, the last stage of which is a power amplifier with a step up transformer in its output circuit. Loud signals will produce enough voltage across the terminals of the transformer to produce quite a shock. This arrangement can be used to amuse your friends with "a shock by wireless" or it can be turned into more practical use by providing a means whereby the deaf can receive telegraph messages.

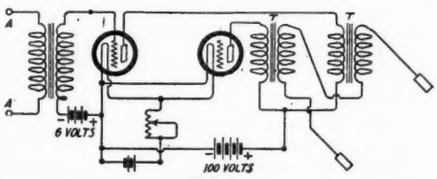


FIG. 3

This is a Modification of the Circuit, Fig. 2, for the Touch Reception of Weaker Signals.

Fig. 3 shows two amplifiers in parallel with the secondary coils of their respective transformers connected in series to make it possible to receive weaker signals.

The amplifiers make use of the ordinary audions readily obtainable on the market today and amplifying transformers of any of the better types among which might be mentioned the following: Acme, Federal, Rasco, Radio Corporation and others.

It is hoped that with the aid of the audion and some such method of sense reception as the one just described, the deaf may be added to the ranks of the "Radio Enthusiast."

$300.00 Prize Contest

The Simplest Radio Outfit

BE sure to read the current issue of SCIENCE AND INVENTION, containing the great $300.00 prize contest, entitled *The Simplest Radio Outfit.* The Editors of SCIENCE AND INVENTION magazine desire to convert this year thousands of laymen to the Radio game, and in order to do so they wish to make it as easy and painless to the public as possible. They realize that the average layman does not want to be bothered with difficult hook-ups, expensive outfits, etc.; but the new convert to the art "wishes to be shown" first, before spending much money.

Hence, if it is possible for him to receive signals and concerts with an outfit costing him a very small sum of money, he will soon wish to have a good radio outfit. But the Editors of SCIENCE AND INVENTION magazine first wish to convert the man in the street to Radio. Hence the $300.00 prize contest.

1st Prize	$100.00 in Gold
2 Prizes each of	50.00 " "
4 Prizes each of	25.00 " "
Total,	$300.00

Every reader of RADIO NEWS is an expert in the Radio game, and he ought to know how to tell the average person how to go about making the "Simplest Radio Outfit." Someone is going to win a worth while prize. Why not you?

For further particulars, rules of the contest, etc., see the current issue of SCIENCE AND INVENTION magazine, on the newsstands now. This magazine also contains a Radio Section, which is of interest to every Radio man.

Radio Frequency Amplification

By ROBERT E. LACAULT

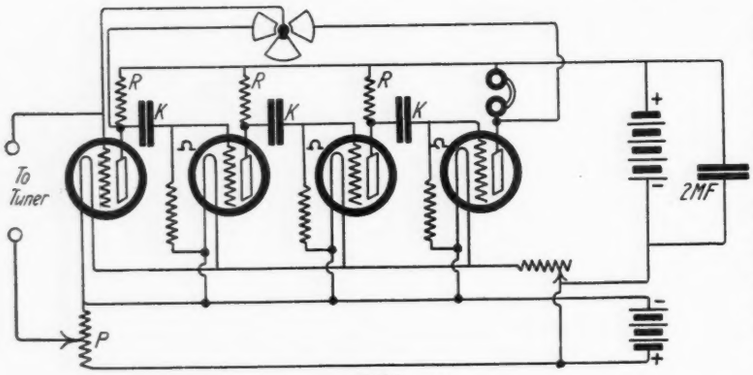


FIG.1

In this four-step resistance coupled radio frequency amplifier all the tubes act as amplifier and detector at the same time, and the circuit may be made to oscillate by means of a coupling condenser for the reception of continuous waves.

MUCH has been said lately about radio frequency amplification and its marked advantages for the reception of weak signals, but little practical information may be had in the current periodicals and technical magazines on this subject. Moreover, when radio frequency amplification is to be used for short waves, the problem presents itself under a new face, as different results are obtained with the various types of radio frequency amplifiers at different wave-lengths.

When properly designed, a radio frequency amplifier enables one to receive on a loop aerial of small size, reducing the trouble caused by interference as well as statics, which are experienced when using an outdoor aerial. If such an aerial is used, with a selective circuit, a wonderful sensitivity is obtained and a very long range may be covered with a transmitter using very low power, if, at the receiving station, such an amplifier is used.

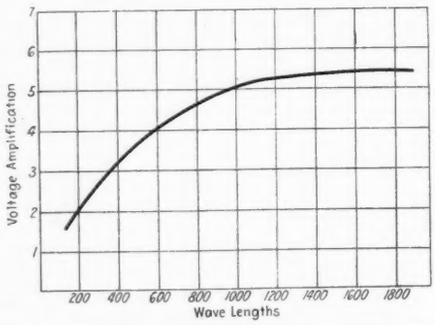
THE VARIOUS METHODS OF RADIO FREQUENCY AMPLIFICATION

Radio frequency amplification consists of amplifying the oscillations received before they are rectified by the detector and since the rectified current is equal to the square of the voltage applied to the detector, it is easy to understand how much sensibility may be obtained in the reception of weak signals. For instance, if the amplification obtained with the radio frequency amplifier is equal to 200, which is rather easy to obtain, the rectified current is multiplied by 200, giving a total of 40,000.

Undoubtedly the simplest type of R.F. amplifier is the resistance coupled one, which is shown in Fig. 1. Such an amplifier makes possible the reception of Transatlantic stations on a loop aerial a few feet square, and if one or two stages of audio frequency amplification, using transformers, is added to it, it becomes possible to work a loud talker or operate a recording apparatus.

In such an amplifier the variations of potential from the plate circuit of one tube are applied to the grid of the following one, which is kept at a proper mean potential by means of a grid leak of suitable resistance, so as to make the tube function along the straight portion of its characteristic curve. A certain variation of tension applied to the first tube is amplified a certain number of times, say about six; consequently, the tension applied to the second tube is six times stronger than the initial one. This variation, being amplified six times by the second tube, that is 36 times the original one, the amplification is equal to the square of that produced by one tube. It is easy to see in what proportion the amplification increases because, with a three-step R.F. amplifier of this type, the oscillations received are amplified 6 x 6 x 6, or 216 times.

When resistances are used as a means of coupling between the various tubes, no special detector is needed, as all the tubes may be used at the same time as amplifiers and detectors, by connecting the grids to the positive terminal of the "A" battery through a grid leak of suitable resistance. Under these conditions the rectification of very weak oscillations occurs almost exclusively in the last stages, for it is only after several stages of amplification that the oscillations are made strong enough to operate the tubes as rectifiers. On the contrary, if very strong oscillations are applied to the amplifier, they are rectified by the first tubes, being merely transmitted by the following stages with very little amplification.



This Curve Shows the Rather Poor Efficiency of a Resistance Amplifier on Short Wave Lengths.

This property is an advantage in the reception of signals, for the disturbances of atmospheric nature, and interference caused by near by stations are reduced, while the very weak transmission which it is desired to amplify, is made audible and of about the same strength. Furthermore, with suitable tuning devices, a great selectivity may be had, making the resistance coupled amplifier an ideal instrument to be used with loop aerials.

The resistance coupled, as well as the other types of radio frequency amplifiers, does not produce very strong signals and the experimenters building such amplifiers should not expect to hear the signals with the phones on the table, for if the rectified signals are to be amplified to a great extent, they may be boosted up by an audio frequency amplifier which the English very properly call a "note magnifier." The rôle of the radio frequency amplifier is to boost up the oscillations so that maximum potential is applied on the detector tube, which works most efficiently when maximum potential variations are applied on the grid. If the detector tubes actually on the market had an absolutely straight characteristic curve, they would be much more sensitive to very weak currents, and would rectify in the same proportion weak and strong signals. Unfortunately nobody has been able as yet to produce such a tube and the only means of operating the detector tubes at maximum efficiency with very weak signals which would otherwise be inaudible is to amplify them before applying them to the detector.

The great disadvantage of the resistance amplifier is that, owing to the capacity between the connections and especially between the elements and connecting wires inside of the vacuum tubes, it is difficult to make it sensitive and efficient at short wave-lengths, and unless special vacuum tubes are used, the apparatus really amplifies only from about 1,000 meters up, as may be seen in the curve Fig. 5, showing the value of amplification obtained at various wave-lengths. For short wave-lengths, the other types of R.F. amplifiers are much more preferable and efficient.

THE INDUCTIVELY COUPLED R. F. AMPLIFIER

For the radio frequency amplification of amateur wave-lengths, at about 200 meters, the transformer coupled amplifiers will give maximum results; air core transformers should be used or else tuned circuits acting as auto transformers, with the coupling between the plate of one tube and the grid of the next one made by means of a small capacity. If transformers are used, as shown in Fig. 2, they should be designed especially for a certain wave-length, for their range is very small and, for instance, a transformer designed for 200 meter wave-length will be efficient only from about 175 meters to 225 meters; for longer waves, some other transformers having more turns should be used. This is a great inconvenience if such an instrument is to be used for all round work, and unless the transformers are made interchangeable, a radio frequency amplifier

(Continued on page 620)

Transformer coupled radio frequency amplifiers are more efficient, but only on a short range of wave lengths. The primary of each transformer may be shunted by a small variable condenser making this form of amplifier very selective.

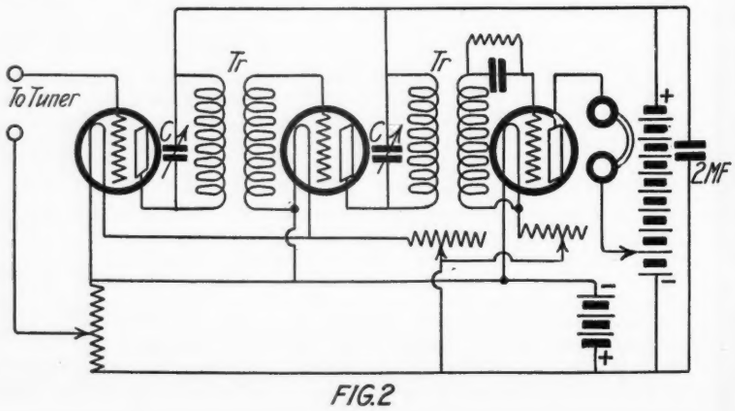


FIG.2

Radio Digest

NEW DIRECTIONAL RADIO SYSTEM.

Discovery of a method whereby wireless messages may be sent to a definite receiving station without the danger of being received by other stations is claimed in an announcement by the Official Press Bureau.

A Ukrainian electrical engineer named Chayko is responsible for the discovery and it is stated that, by means of a simple apparatus, Chayko straightens out and groups what are termed the 'locked power lines" of the magnetic field into parallel rays. These rays, he says, can penetrate mountains, thereby avoiding the necessity of high antennæ.

It is also asserted that the discovery will enable the location from the surface of metal deposits in the earth and will be of great service to medical and other sciences.

Chayko is continuing his experiments for the Scientific Technical Department of the Ukrainian government.

BROOKLYN ACADEMY OF MUSIC TO HAVE RADIOPHONE.

A permanent radio station is to be established on the roof of the Brooklyn Academy of Music, where members will be able to communicate with distant points and enjoy radio concerts broadcasted from different radio stations. Director Charles D. Atkins of the department of education, made this announcement in a report at the monthly meeting of the Board of Trustees of the Brooklyn Institute of Arts and Sciences at the Academy.

The first exhibition and demonstration of wireless telegraphy and telephony will be conducted by the department of electricity, December 29-31. Prof. Erich Hausmann, of Polytechnic Institute, who is president of the electricity department, will be in charge of the exhibition. Director Atkins said he had secured permission from the Academy Board to install antenna on the roof of the Academy, where a permanent radio station will be established.

NEW RADIO CONTROL ALSO LANDS PLANES.

In addition to controlling the flight of an aeroplane by Radio, attempts are being made in France to devise mechanism to enable a plane not only to ascend pilotless but also to land without any hand on the controls.

Devices in course of perfection show wonderful ingenuity. In one case, a machine without a pilot, its engine having been started, runs across the aerodrome, causing to revolve at a rapidly increasing pace a small two-bladed fan or screw between the wings. The fan as soon as it turns a certain number of revolutions actuates mechanism which places the control surfaces of the machine in the right position for ascent, its manœuvres while aloft being controlled by wireless.

When the time comes for landing, a signal has the effect of unrolling beneath the aeroplane a length of wire with a weight at the end. This weight, touching ground while the machine is at some little height switches off the engine and causes the rear surfaces of the plane to set themselves in such a position that the landing wheels of the machine make a smooth contact with the ground.

French Radio control of aeroplanes has achieved already a notable triumph. A large machine was taken up by its pilot, who left the controls and allowed the machine to be manœuvred for more than an hour by wireless operators in a land station far below. At a given signal the pilot resumed control and landed.

PRACTICAL QUESTIONS WITH ANSWERS FOR THE RADIO OPERATORS' LICENSE EXAMINATIONS.

By Jas. E. Smith.

The purpose of this book is to furnish its readers with a suitable preparation in the operating principles, constructive features, diagrams of connections, maintenance and repair of radio equipment used in commercial stations. It also includes the essential laws governing radio communication along with useful formulæ and tables employed in the solution of radio problems.

It is not a text book on radio, but, as its name implies, it is a systematized review book answering many difficult questions in a clear and concise manner. The questions have been developed from notes collected by the author during the past seven years, while training several hundred students for the U. S. Government Radio operators' license examinations.

The numerous diagrams and practical questions found in this book, will prove most helpful to applicants for radio licenses, as they cover the subject of transmission and reception in damped and undamped waves, as well as the various measurements to be made by the operators in a commercial station. This book, profusely illustrated, clearly explains the adjustment of arc transmitters and continuous wave stations of other types.

By reading this manual, the future radio operator will become accustomed to the questions asked in the examinations and will find it most useful as a handbook to be kept in the radio cabin, after he has become a professional "op."

This book is published by the National Radio Institute, Washington, D. C.

Radio Articles in January Science and Invention

Radio Central—The World's Largest Wireless Station. By Arthur H. Lynch.

Jazz from the Air. By Robert E. Lacault.

Question and Answer Column.

Science in the Apartment House de Luxe.

Radio Directed Bombing Planes for Destroying Tornadoes. By C. S. Corrigan, C.E.

Shall I Take Up Engineering? In which radio and electrical engineering are discussed. By H. Winfield Secor.

PARIS PLANS NEWS SERVICE BY RADIOPHONE.

A radiophone news service will soon be distributed from the Eiffel Tower station in Paris. The news will consist of important financial and political events in France and throughout the world, the news from foreign countries being picked up by Government radio stations. This broadcasting service will be for the benefit of the amateurs, banks and newspapers equipped with receiving stations.

This announcement was made by General Ferrie, Chief of the Signal Corps of the French Army, who also said that it was expected to arrange soon a radiophone service between Paris and London, so that any subscriber to the telephone service could talk with a correspondent in London, or on a ship or airplane during the trip from France to England.

AMATEUR TRANSATLANTIC TEST.

Since the beginning of the tests carried on by the A. R. R. L. between this country and England, it has ben reported that 26 of the American amateur stations were heard in England. This report was sent by Paul Godley, representative of the League in Scotand, who, with Mr. P. R. Coursey, Editor of the *Radio Review*, verified the reception of the messages by the English amateurs.

This is for American amateur radio a wonderful achievement, showing the efficiency of some of the amateur sets, which, with 1-k.w. of power, succeeded in spanning the Atlantic, a feat which formerly required fifty times that power. The complete results of these interesting amateur Transatlantic transmissions will be given at a later date when all the details are known.

To this day 26 stations have been heard in England, but it is expected that more will succeed in reaching the other side.

PREPARED RADIO MEASUREMENTS WITH SELF COMPUTING CHARTS.

By Ralph Batcher.

A large amount of radio equipment is constructed by amateurs with the cut and try method, and even the commercial and engineering fields are not free from users of this method. An English textbook on higher mathematics states that "Good guessing is a fine art," but not every radio experimenter is an artist, so there is a field for a book that is devoted entirely to simplifying the methods of determining electrical and geometrical constants for radio instruments and appliances.

The charts included in this book represent formulæ that are apt to occur in ordinary radio computations. Some of these have doubtless been neglected on account of their relative complexity heretofore, but it is hoped that with a simplified method of obtaining a solution they will become more valuable.

Charts of this type have not been used extensively heretofore in the radio field, although a few have ben designed and published. They are designed to eliminate all mathematical work, except in a few cases when it is necessary to evaluate simple ratios, and require no special equipment except a straight-edge or ruler. For this purpose a draftsman's transparent triangle is desirable.

The method of operation for an equation with three factors is to lay a straight-edge across two scales at points corresponding to the known values and the answer is indicated where the same straight line intersects the third scale. This same principle is extended for charts containing four or more factors. The method is specifically described with each chart.

It should be noted that while the description may call for a "line" between two points, and illustrative examples show such a line, it is unnecessary in most cases to actually draw such a line in with a pencil if a transparent straight-edge or stretched edge is used.

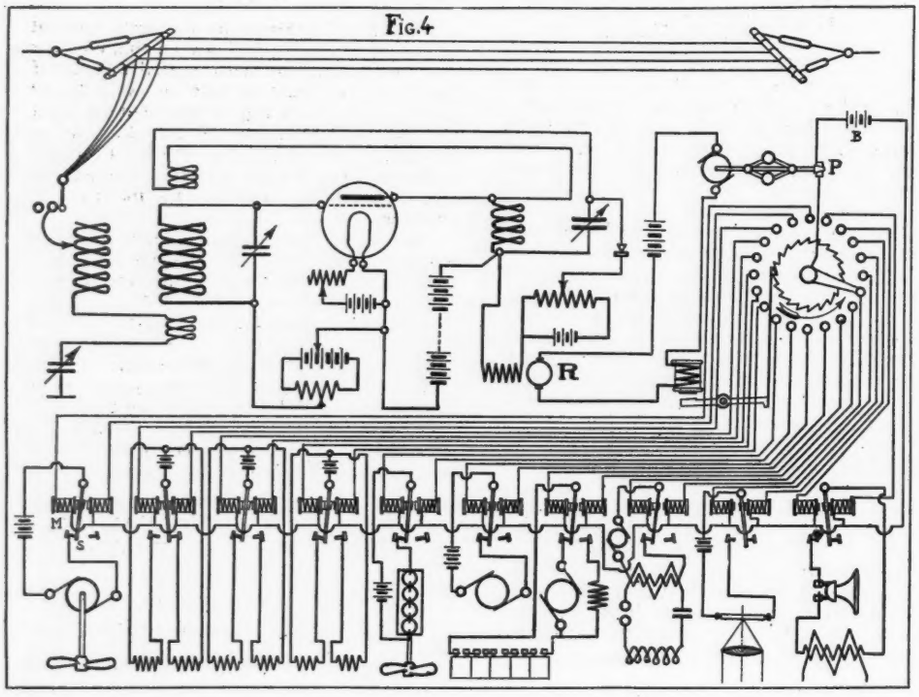
The accuracy of these charts is above the accuracy with which the various factors that enter in the formulæ can be measured with ordinary means, and will give the answer to any radio problem without operations, thus giving the answer in a minimum of time.

This book, which fills a long-felt need, represents a great amount of work and will certainly be welcomed by the radio engineer

(Continued on page 673)

A Radio Control System

By AUSTIN RIU



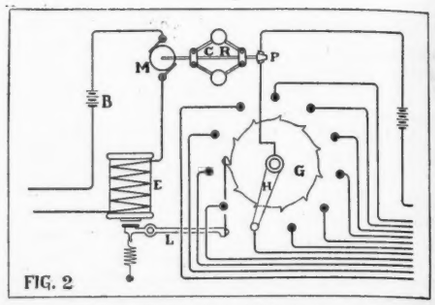


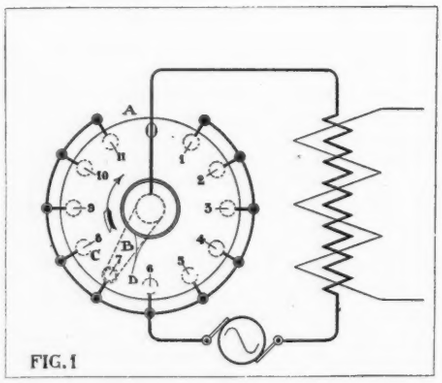
Fig. 2 above shows the distributor and time device of the radio control system which is shown in detail in Fig. 4 on the left. Only one stage of amplification is shown for clearness in the receiving circuit.

I SHALL describe in this article a radio control system which I designed, for the control of a submarine while on or under the water. This system embodies a special feature which shall be described in a future issue of RADIO NEWS, being in itself an interesting novelty.

It is well known that, while submerged, it is possible to receive radio signals on board a submarine. This is used in the present invention to control the ship while under the water. In order that the submarine be not controlled by other stations or accidentally by static, very sharply tuned circuits are used. At the transmitter, Fig. 1, a controller system is used, which consists of a dial A, bearing in front of each point the name of the control corresponding to this particular point. A pointer fixed on the shaft indicates which point the switch blade is on, and a handle mounted on a shaft allows the operator to switch quickly the blade on any of the points. This system moves constantly in a clockwise direction.

Each time the blade of the switch comes in contact with a point, it closes the primary circuit of the transmitter and one emission of waves is radiated by the antenna. After each control, the switch blade should be returned to zero. These emissions act upon the receiver installed aboard the submarine and operate the proper control, as may be understood by looking at the diagram of the receiver, Fig. 2.

At each impulse received in the antenna of the submarine, the receiving set closes



Connections from the controlling device to the transmitter are shown here.

a relay circuit which, in turn, completes the circuit of the battery B, in which is inserted the winding of the electromagnet E, and a small electric motor M, which consequently runs as soon as the circuit is closed and the amrature L is attracted by the electromagnet E. These two operations are simultaneous and produce the following effect: First, the speed regulator CR, run by the motor, pulls back the contact P, producing a gap in the circuit of the control relays; and second, the spring supporting a finger mounted on the armature L, pulls the ratchet wheel G the length of one tooth, moving the switch blade H from one point to another.

The inertia of the centrifugal speed regulator makes it run for a few seconds after the current in the motor is cut off and allows the contact breaker P, to complete the circuit only when the switch blade H, is on the proper point, for during the time that it passes over the other point, the motor being supplied by impulses, keeps the regulator running and the contact P. open.

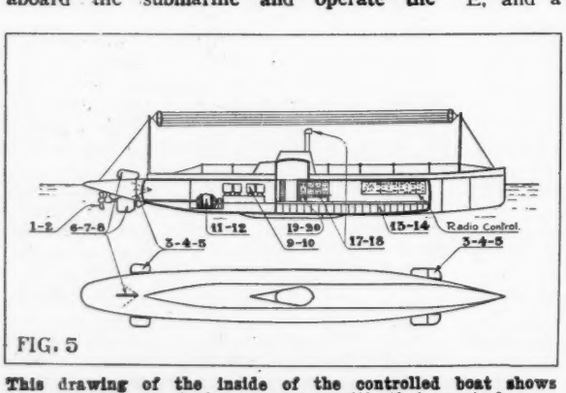
The operation of this system may be better understood by referring to the general hook-up in Fig. 4, showing the complete receiving system on board the submarine. For instance, if it is desired to start the submarine, and supposing the blade of the selector is on the position shown in Fig. 4, it would require six dots sent by the transmitter to move it to the proper point. The functioning of this is as follows:

The impulses received in the aerial are detected and amplified by the proper instruments and operate a relay R, closing the circuit of the local battery operating the motor and the electromagnet, as explained previously. If six dots are sent, the spring supporting the finger will move the ratchet wheel six teeth and bring the blade in contact with the upper center point, completing the circuit of the battery B, which energizes the electromagnet M, as soon as the contact P closes the circuit. This results in the closing of the motor circuit by the armature S, which, being attracted to the left, closes the circuit. The operation of all the other relays is similar.

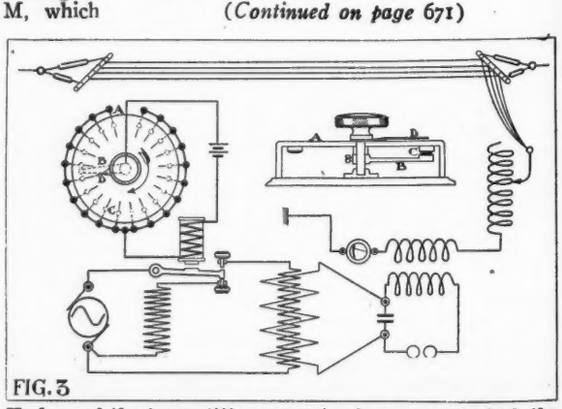
The various controls operated aboard the submarines are, from left to right:

1. Motor start.
2. Motor stop.
3. Diving rudder down.
4. Diving rudder horizontal.

(*Continued on page 671*)



This drawing of the inside of the controlled boat shows the arrangement of the apparatus with their control numbers corresponding to the relays.



Hook-up of the transmitting apparatus by means of which the radio-controlled boat is operated from a distance.

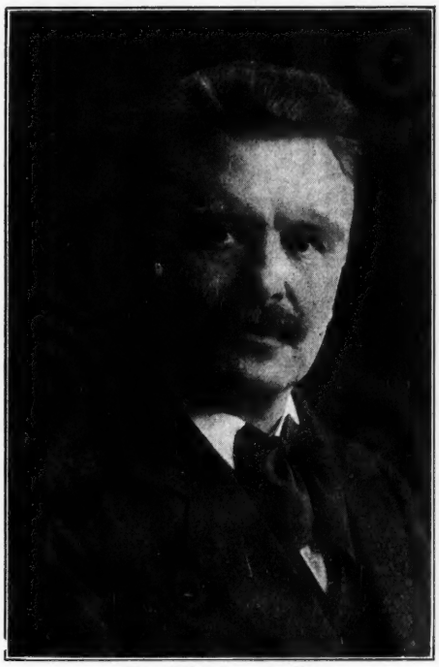
Who's Who in Radio

No. 12 VALDEMAR POULSEN, D.Sc., D.Ph.

DR. POULSEN was born in Copenhagen, Denmark, November 23, 1869. He studied at the University of Copenhagen from 1889 to 1893 and entered the Technical Department of the Copenhagen Telephone Co. in that same year, where for a number of years he superintended the electrical testing operations. He colaborated with Professor Pedersen for many years and carried on extensive researches in telephony and telegraphy. He was a member of the Board of the Telegrafonen, Ltd. (Poulsen Patent), from 1902 to 1916. He joined the Board of the Dansk Telegrafonen Fabrik, Ltd., in 1909 and that of the Poulsen Wireless Telephone and Telegraph Co., U. S. A., from 1909 to 1911.

Dr. Poulsen's researches along the radio line were especially on continuous wave transmission and reception. He designed a system of radio telegraphy and telephony using arcs burning in different gases as a source of high frequency oscillations and succeeded in developing a practical system, which was used in commercial stations. The reception was effectuated by means of the Poulsen tikker and the signals registered on the telegraphone, which operates on the electromagnetic principle and is well known, being still used at the present time under different forms.

Dr. Poulsen was one of the first to experiment with radio telephony; he used his arc as a source of continuous waves and devised several means of modulating the output. He particularly raised the arc to the status of a practically operative generator of radio frequency energy by placing the entire arc in an atmosphere of hydrogen, or a hydrocarbon vapor, using a carbon electrode for the negative side and a copper anode for the positive side. He also improved the functioning of the arc by rotating slowly one of the electrodes and placing it in a strong magnetic field; except for certain constructional details, this is the Poulsen arc of today.



Dr. Valdemar Poulsen

As early as 1906, he established radiophone communications over a distance of 600 ft. using antenna only 15 ft. high. In 1907, with a regular equipment, communication was established between Esbjerg and Lyngby, a distance of 170 miles. The antenna height was 200 ft., the wave-length 1,200 meters and the antenna power 300 watts. A little later, phonograph music sent from Lyngby was heard in Berlin, a distance of about 300 miles, although the modulating system did not allow the whole output to be modulated. The intensity in the aerial, during these experiments, was 6 amp.

Dr. Poulsen holds the medal for merit in gold, with crown. He is a fellow of the Danish Society of Science and he received, in 1900, the Grand Prix of the International Exhibit in Paris. Among his publications may be mentioned: "A Method to Produce Undamped Oscillations and Their Use in Radio Telephony," also a book, "The Wireless Telephone." He was official reporter at the International Congress of Electric Applications in Torino, Italy, in 1911, and at Copenhagen in 1912. Dr. Poulsen is a member of the American Institute of Radio Engineers.

Faults of the "Q" List

By W. T. BURFORD

IF most of the publications of the International Telegraph Bureau at Berne that pertain to radio, it can be said that they are compiled with scrupulous accuracy and attention to **detail**. However, the list of authorized radio telegraphic abbreviations issued under the service regulations of the International Convention, although admirably designed in many ways, is not beyond criticism in some respects. Such a list should, in order to fulfill its function, help to expedite communication between all radio stations and afford a ready means of overcoming the language difficulty in the transmission of messages between stations of different nationalities, but experience in using it impresses one with its shortcomings and its redundancies.

The addition of QTC to the list some time ago, and the cancellation of the interrogative form of QRU seems to indicate that whatever care was taken in the original compilation, little enough thought is applied to its amplification. QRU formerly signified, "I have nothing for you." As a question it stood for "Have you anything for me?" and was one of the most frequently used abbreviations of the whole list. QRJ was used to signify "I have —— words (*or messages*) to transmit," and nobody experienced any difficulty in making himself understood. But the Berne Bureau steps in and duplicates QRJ with QTC, confuses the list, and certainly leaves us no better off.

If the list is supposed to exist to facilitate the handling of radio traffic, such abbreviations as QRC and QSM only serve to encumber it. Meaning "correct bearing" and "true course" respectively, they are of purely navigational interest, and even in that respect are used only once in a "blue moon." They might well be discarded. If it is necessary for one ship to ask another his true course or bearing, it can be done by means of a brief message; there are many questions of more frequent occurrence that are already omitted from the list. It is noticeable, by the way, that when direction-finding stations first came into use, instead of slightly altering the meaning of QRC to make it fit the case and to let it serve a purpose at last, a new symbol was invented, and now we have QTE. QRG is another abbreviation of purely nautical interest. Why should an operator, or even a ship's captain, want to know what company (or line) another vessel belongs to, except as a matter of idle curiosity? Even then, Lloyd's register is available. If the question were: "What administration controls your radio equipment?" it would be of great practical utility for abstracting purposes. As things are, however, this very necessary question has frequently to be asked of unlisted boats by means of a service message, while QRG remains totally unused.

In suggesting the omission of these "navigational" abbreviations we are not unmindful of the fact that one of the main purposes of radio is to aid navigation, but these do not aid it because, through desuetude, they cannot be readily called to mind by any operator. For the same reason the distress call was changed from the original CQD to SOS; being so rarely used, its form had to be simplified in order to prevent its being forgotten. QRD and QRF would fall in the same navigational category if it were not for their being frequently used in giving or asking for a TR. A TR being a routine message, QRD and QRF are thus used to facilitate traffic; they are never used to direct the movements of a ship. QRB is also of use in TR's, besides which it is of service occasionally between land stations.

QSW and QSX, referring to increase and decrease of spark frequency, are seldom, if ever, used and would never be missed if they were omitted from the list.

The list is deficient, in spite of its redundancies. Among the defects that all operators cannot have failed to recognize, none is more conspicuous than the absence of any means whereby one may briefly ask for repetition of part of a message. We find operators here and there overcoming this difficulty by various devices. To get the repetition of one word, "WA ——," or "WB ——," is sometimes used, meaning "word after ——" and "word before ——" (another word) respectively. This method is good enough, provided the operator at the other end understands it, but it can never become general until a proper Q abbreviation is officially provided to indicate in all languages what the letters "WA" and "WB" stand for in English. To obtain the repetition of more than one word, it is the custom of some operators to say, "GA ——, stop ——;" others, "UD —— to ——;" and still others (especially some Japanese operators) use QTA and get the whole message repeated for the sake of a word or two, and it often happens that the particular word they want is again jammed; then they QTA once more.

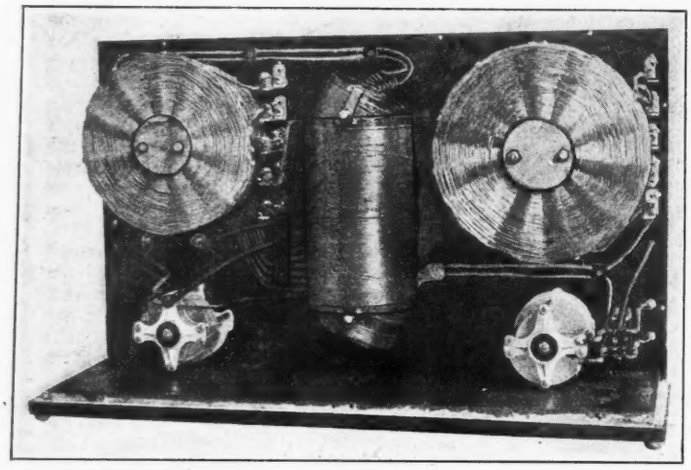
Now and then it happens that owing to the delay in receiving supplements to the

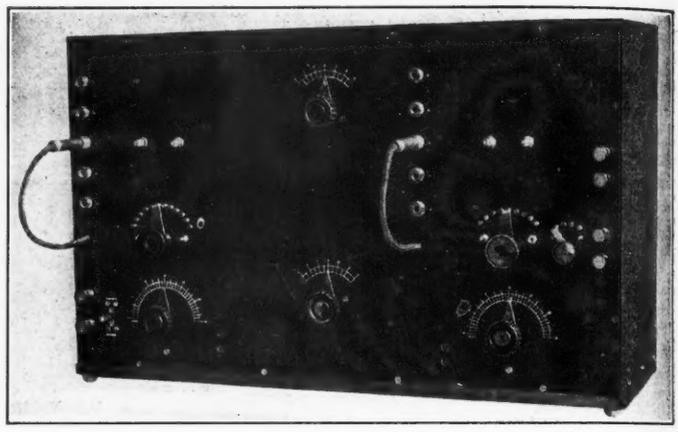
(*Continued on page 668*)

THE RADIO CONSTRUCTOR

A 150-20,000 Meter Receiver

By D. R. CLEMONS





These Photographs Show the Front and Inside Views of a Universal Receiver Which May be Built by the Amateurs Wishing to Receive Short and Long Waves With a Single Apparatus. With a Good Aerial and a V.T. Detector, This Set Will Bring in Distant Arc and Spark Stations.

SEVERAL months ago RADIO NEWS published a brief article concerning a receiving instrument for 150 to 20,000 meter range. Since then it seemed that more detail on this instrument would be desirable to those intending to apply this design. A brief review of the circuits and illustrations will be given.

A very simple electrical circuit is used; being merely an inductively coupled receiver sharply adjustable on all wave-lengths. Any section of inductance not required for any desired band is effectually disconnected from the electric circuit by inserting plugs into the jacks shown in the illustration. A four-spring key switch is provided for connecting a .0015 mfd. variable condenser in series or parallel with the primary circuit. A sketch shows the manner in which the primary and secondary loading coils are mounted. Nine large stagger-wound inductances of 4 millihenrys each are employed in the primary, while five similar coils are used in the secondary circuit. A primary coupling coil of .5 millihenry is axially mounted to rotate in the lower end of a large secondary unit of 11 millihenrys. Two sections of banked winding are wound about this tube, the lower portion being tapped at progressive values for lower wave-lengths. A feed-back, or tickler coil, acts directly into the upper portion of this secondary unit. For very long waves, inductances may be added by moving this secondary plug, which also places a condenser of .001 mfd. across the necessary inductive circuit. An adjustable condenser in steps of .0005, .0015 and .0025 mfd. is included in the set to by-pass plate currents independently of the tube used when receiving continuous waves by the autodyne method.

Important circuit features that may not be easily understood are shown in the diagram. The primary coil and all loading coils are seen to be in series, normally; but different values of inductance may be included by inserting the plug in one of the jacks which also disconnects all unused units. These jacks are single circuit closed type. Removal of the plug allows the springs to make contact, closing the electrical circuit through them. One spring should be connected directly to the metal jack frame. A plug consists of a metal sleeve terminating in an insulated ball-tip which lifts away one spring, and the sleeve makes direct contact with the frame of the jack. The lead to the plug is soldered to the sleeve, but the ball-tip is not in circuit, and serves to disconnect the unused portions of inductance. It is imperative that connections to springs and frame be made as shown in the sketch, which method gives greater contact area.

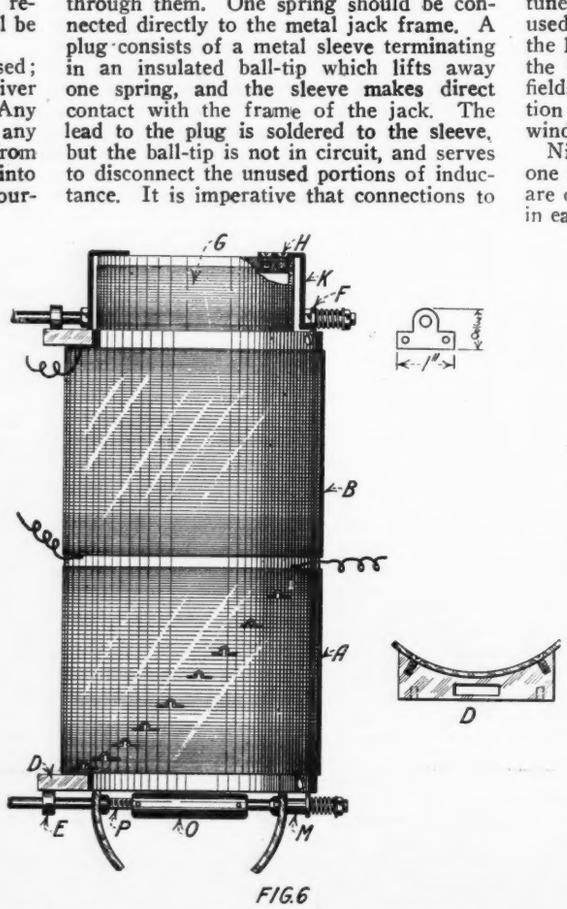


FIG. 6

Details of Mounting of the Coupling and Tickler Coils on the Main Inductance.

The small primary coil is used alone up to 450 meters. The first primary loading coil is tapped at 12 values for carrying the tunes through the commercial bands when used with the primary coupling coil. As the loading unit is combined on long waves, the builder must connect them so that all fields add, i.e., the direction of electric rotation must be continuous through all the windings.

Nine coils are required for the primary, one of these being tapped at 12 points. All are otherwise alike, although identical turns in each are not important. Five similar coils are made up for the secondary. By using a miter-box, a 2½-inch rolling pin is cut into 14 discs, each ¾" thick. A ¾" strip of paper is wrapped about one disc and the point of overlap is marked. A line along the strip center is subdivided into 11 points, as shown in sketch No. 3. This strip is wrapped about each disc and the points marked through into the wood. Holes are then drilled into the discs, after which wooden pegs are set into position and glued to strengthen the frames which then appear as in Fig. 4. About one gross of meat-skivers will be required for all frames. Skivers are wooden pegs about 3/16" thick used for pinning meats in markets, where they may be had cheaply. Nine such frames are wound with No. 24 single cotton wire. The frame is turned slowly as the wire is staggered to the right and left of the pegs until a depth of 2¾" is reached. Protruding pegs are then cut off and the entire coil heavily varnished with insulating material. One of these nine coils is tapped at 11 points and mounted directly behind the panel, as No. 1 in Fig. 5. All coils are then mounted upon two brass tie-rods passing through the discs as shown in Fig. 5. The entire grouping is shown in the diagram of connections.

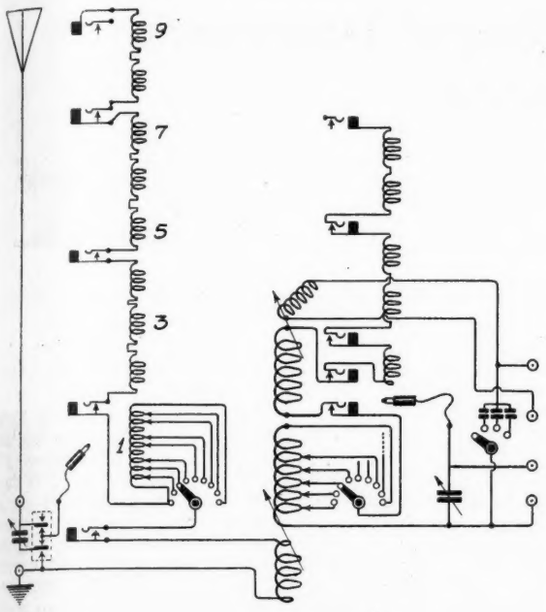
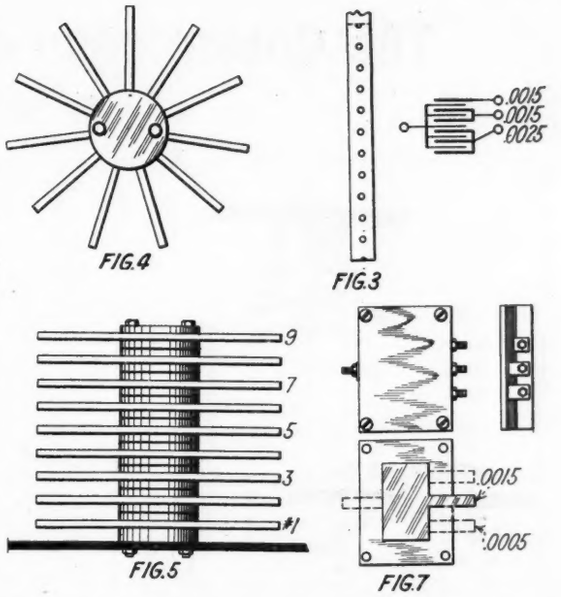


Diagram of Connections for the 150-20,000 Meter Receiver.



The Method of Construction and Assembling of the Basket Type Inductance, and Fixed Condensers, is Clearly Illustrated in This Sketch.

Five secondary coils are wound up in a similar manner with No. 26 single cotton to a depth of 2¾" each. None of these secondaries are tapped.

A large bakelite tube 4" in diameter and 7½" long supports two bank wound sections of secondary inductance, as shown in Fig. 6. The manner in which the smaller tubes are rotated is not important, and this feature may be left to the builder. Fig. 6 shows the method used here. Two bakelite brackets, cut to conform to the tube surface, are used to mount the tube before the panel, as shown at D in Fig. 6. Both tickler and primary are rotated by ⅛" rods operated from the panel front. Brass supports are used on each mount, the outer support being of sheet brass bent to fit the interior of the tube where it is held by small screws as at F in Fig. 6. A short length of rod projects outward and terminates in a rather stiff phosphor bronze spiral spring which provides a friction bearing to hold the tubes securely in and adjusted position.

The two sections of secondary are wound separately, the lower coil A being carefully tapped for overlapping bands of wavelengths. No. 24 single cotton is two layer bank wound on this tube. Taps on coil A on the 8th turn for 150 meters; also on 20, 40, 60, 90, 120, 160, 200, and so on. Such coils are wound by tying a cotton cord about the tube where the winding is to start and end, after which the entire outer winding surface is covered with a heavy coat of mucilage. Small holes are drilled into the tube to receive and attach the ends of the windings. As winding progresses, the dry mucilage is dampened ahead of the winding which holds the wires securely. A

(*Continued on page* 636)

A Novel "B" Storage Battery

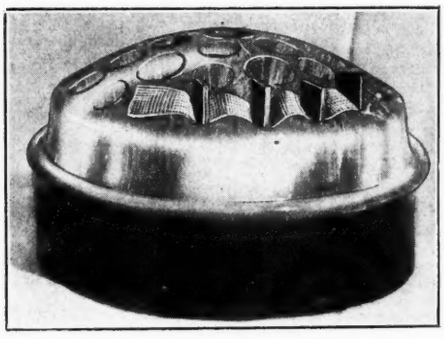
By R. U. CLARK, 3d

RADIO "B" batteries of the dry cell type have been improved to a state where they represent an excellent investment for ordinary use, but there are many cases where a high voltage storage cell is more satisfactory, especially in experimental work, and almost everyone likes to experiment, often at the expense of the standard dry "B" battery.

Several types of high potential storage cells have been brought out during the past two years, but most of them are of conventional design and are inherently bulky and expensive, as well as fragile.

The storage battery described here is the result of much experimenting, and anyone who undertakes the construction of this type can do so with the assurance that he is wasting neither time nor money.

One of the greatest difficulties in making batteries of the kind just mentioned is met with in the selection of a suitable case or container. The integral type, incorporating all the cells in one piece is by far the best,



This Cleverly Made "B" Battery is Very Compact and is Economical as it is Possible to Recharge it When Down.

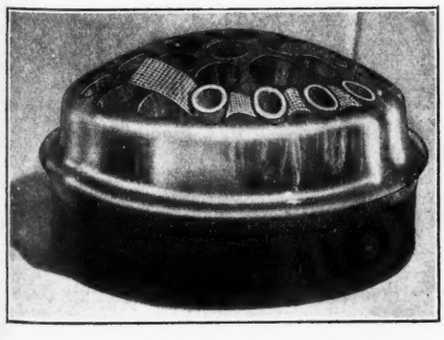
but generally the most expensive. Separate cells require racks, assembling, spacing, etc., and are the most expensive type in the long run.

There are several styles of glass and pottery castings on the market today, in the form of flower holders, which make excellent "B" battery containers, one of the best types being shown in the first illustration submitted. This latter type is about 8" in diameter by from 3" to 4" deep, and is made with about 37 small wells for holding flowers separately. The cost new at retail is about $1, but slightly damaged pieces can be found for half price, which will do as well, and at wholesale, new holders can be bought for about 45c each, for the best domestic glass. Properly fitted, these containers will make a powerful "B" battery of 75 volts which will last several years.

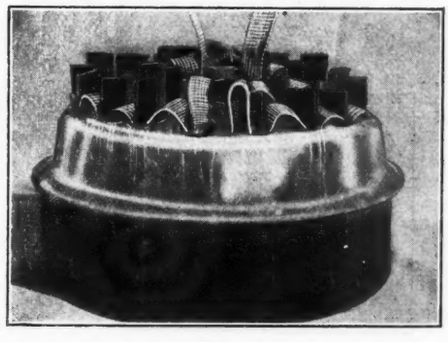
The majority of the glass flower holders mentioned above are made with the wells open at both ends, although some of the more expensive imported types, which are also slightly larger, are sealed at one end. This need not worry the purchaser, however, as the complete unit, of the open end type, can be sealed at the base in a very few minutes. To do this it is only necessary to heat the holder to about 200 deg. F. (as slowly as convenient) and then set the same in a shallow pan of melted tar or storage battery sealing compound of about the same temperature, and allow both to cool slowly.

Some of the larger flower holders mentioned above are made with a domed center and slightly larger wells around the inner portion, but as the plates are to be made all the same size, this slight inequality will not be noticed in the finished battery. In addition to acting as a draining surface for any overflowing cell, this dome-shaped portion brings the tops of some cells out of line with those which might otherwise shut their water-line out entirely from the side

(*Continued on page* 638)



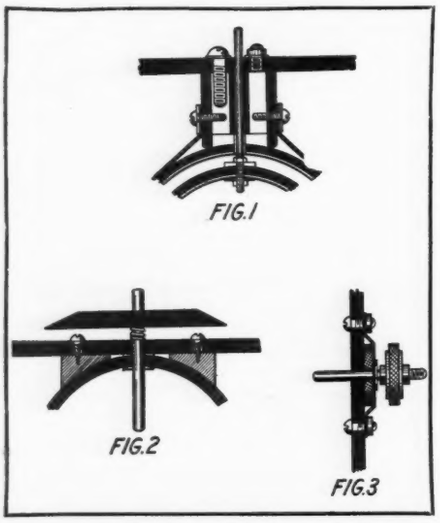
This Shows How the Lead Plates May be Mounted, With Rubber Separators, Into the Holes of the Casting.



The Completed Battery With Hard Rubber Separators Between the Plates of Each Element.

The Construction of Lattice-Wound Variometers

By ALLAN R. KENWORTHY



Variometers Wound as Honeycomb Coils Have Minimum Distributed Capacity and Consequently Give Best Results; Also, They May be Constructed for Tuning Any Wave Length. The Above Figures Show the Constructional Details of Such Variometers.

THE application of variometers to various radio circuits such as are found in the wavemeter and the regenerative tuner, is too well known to require mention here. It suffices to say that their uniform inductance variation, and freedom from resistance due to sliding contacts, makes them a very desirable piece of apparatus.

The one drawback of the ordinary variometer is the impracticability of constructing them to cover long wave-lengths. To do this requires the use of banked windings which are not rigid and difficult of support. By using self-supporting lattice wound coils for long wave-lengths this difficulty of construction is avoided.

The first step in the construction of the variometer is the winding of the coils which comprise the rotor and stator. As these may be wound to cover a variety of wave-lengths, the winding of but one set of coils will be given in detail. The unilateral winding has been adopted, but should the constructor desire to make use of a winding of another variety, data for it can be found in the back numbers of the *Wireless Age*. The precautions observed in the construction of the coils as outlined below are applicable to windings of any size and variety.

The first thing to be observed is to have the inductance of the two windings as nearly equal as possible. The inductance of each coil can be calculated approximately from the formula given below:

$$L = \frac{.0008\ a^2 N^2}{6a + 9t + 10w} \text{ in milhenries}$$

where a.. is the mean radius of the winding in inches,
t.. is the depth of the winding in inches,
w.. is the width of the winding in inches,
N.. is the total number of turns.

Another method is feasible to determine when the inductance of the two coils is equal, and can be used by most amateurs if the proper precautions are observed. This method consists of using one of the coils and a variable condenser in conjunction with the proper detector, to tune in a sharply tuned station, the wave-length of which you know to be fixed. At resonance a condenser reading is taken and then the other coil is substituted for the first in the circuit. The winding of this coil is then varied until the condenser reading is the same for a condition of resonance in the circuit. Care should be taken that all leads are equal in both cases and that the constants of the circuits, exclusive of the coils, remain the same.

FIG.4

Method of Winding for the Static and Rotor of a Latticed Wound Variometer.

A form is necessary for winding the coils and either of the two described may be used as the constructor sees fit.

For one of these forms a block of hard wood is procured, of 2" in thickness and of sufficient size to permit a circular block, 3" in diameter to be cut from it. If it is desired, this block can be turned out on a lathe. The circumference of the 3" block is then smoothed off with sandpaper. Lines are then drawn ½" each side of the center about the circumference. These lines are to be used as guides for a series of 19 holes which are to be used to hold the winding pegs. These holes are of sufficient size to allow the insertion of a 6-penny finishing nail. Each line should have 19 of these holes equally spaced about it and the holes in one line should be exactly opposite those in the other. The holes should be bored to a depth of ¾".

The other form which may be constructed will permit the winding of coils of a spherical form which will allow less clearance to be used between the rotor and stator forms, something which is highly desirable.

For the construction of this form a wooden ball with a diameter of from 3" to 4" inches should be obtained. Two rows of holes, 1" apart, 10 holes to the row, are bored to a depth of ¾", about the circumference of the ball. The holes should be equally spaced and the holes of one row exactly opposite those in the other.

Having completed either form, winding pegs are fitted in the holes. For these pegs

(*Continued on page 652*)

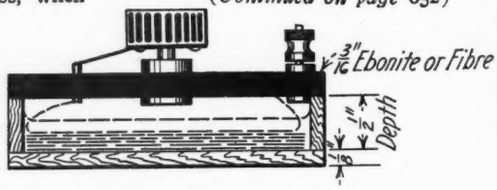
A Simple and Efficient Adjustable Condenser

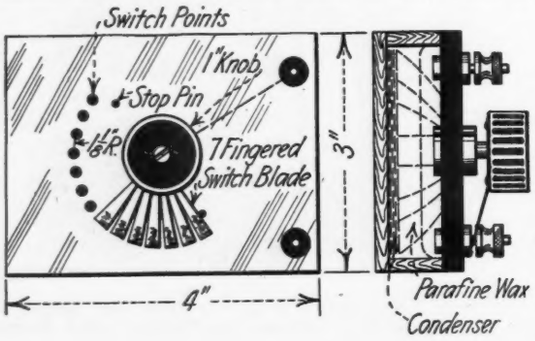
By ALFRED E. WHITBURN

AS many amateurs do not wish to buy more variable condensers than are necessary, and it is difficult to construct them efficiently without a lathe, this form of adjustable condenser will be found very useful in the primary circuit of a receiving set.

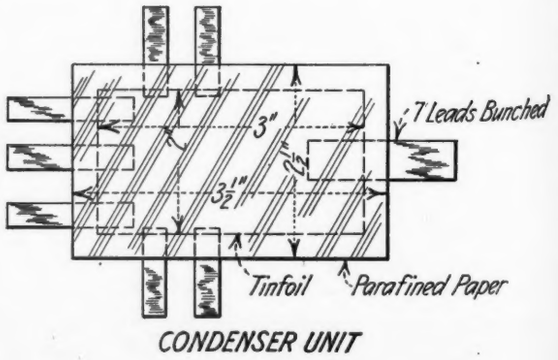
The case is made from ⅛" cigar box wood well soaked in paraffine wax. The outside dimensions are 4" x 3" x 1⅜". The top, which is also the switch panel, is a piece of 3/16" ebonite. The seven-point switch has a seven-fingered blade in the shape of a fan; this is easily cut from thin springy brass, by first drawing it on gummed paper, and sticking it on the brass, when it can be easily shaped with sharp shears. The knob construction is simple and efficient; a brass screw with two thin nuts is required. The screw is put through the panel from beneath, and fastened with a nut. The other nut is soldered to the switch blade, which in turn is fastened to the 1" knob with two small screws. To assemble, the knob is screwed down on the projecting

(*Continued on page 652*)





This variable condenser adjustable by steps will be a useful addition to your receiving set. Such condensers may be used in the aerial circuit to shunt the phones, etc., and to increase the wave-length of tuning coils or loose coupler.



CONDENSER UNIT

Experimenting With Amplifiers

By RAY DIO

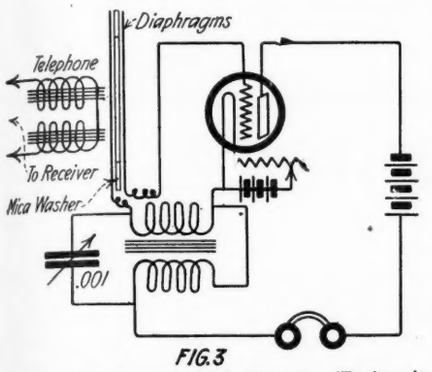


FIG.3

Here is an Unusual V.T. Hook-up, Having in the Grid Circuit a Condenser, One Armature of Which is the Diaphragm of the Receiver. When Vibrating, the Distance Between the Plate is Changed, Varying the Characteristic of the Circuit.

TRYING to get off the old beaten track the author set to work to devise several new types of amplifiers which of course did not work to perfection, but certainly started a new line of thought on amplification.

In the first drawing, Fig. 1, the reader will note that an ordinary receiver is mounted on the stand with an old telephone transmitter. An "E" mandolin string was then soldered from the diaphragm of the receiver to the diaphragm of the transmitter. The transmitter was so arranged that it could be given a slight sideward movement in order to adjust the tension of the mandolin connecting wire. The receiver was connected in the audion receiving plate circuit as is customary, while the transmitter was placed in series with a 22.5 volt "B" battery brick, a 75 ohm telephone receiver and a 400 ohm potentiometer.

STATIC DOES NOT RIDE THE WIRE

At a critical adjustment of the wire tension the signals ride the wire to the transmitter more faithfully than the vibrations caused by the static clicks. It is possible to construct such an instrument with very delicate adjustment of the wire tension, and thereby tune the instrument to the frequency of the vibrations imparted by the receiver diaphragm. This would naturally permit a 500-cycle note to easily travel over the wire and likewise easily block out the lower frequencies caused by static.

This instrument was first constructed with the object of causing amplification in the secondary or transmitter circuit where a local battery supply is furnished; however, it became evident quite early that it could be adapted for a still better purpose. Weak signals from Arlington on the spark are a little weaker on the secondary side; however, as the volume of the sound increases at the receiver diaphragm the secondary circuit begins to show signs of amplification.

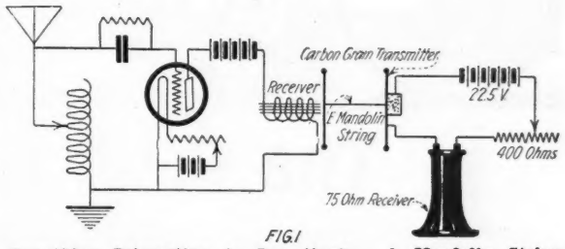


FIG.1

Something Interesting to Investigate. A Mandolin String Connecting the Diaphragm of the Receiver to a Microphone, Transmits the Vibrations From One to the Other.

ANOTHER TYPE

In Fig. 2 I show another type of instrument designed to amplify the signals. This one proved less efficient than the first type. There are some possibilities of making such an amplifier if one had the time to experiment enough with it. At times great magnification of the incoming signals was had, but this was only for a fraction of a second and it could not be held in adjustment. If some one can arrange this device so that it will work continuously as it does for the fraction of a second his fortune is made. In this instrument the same receiver was used. A small piece of "E" mandolin string was soldered to the center of the diaphragm. This was caused to rest on a small pellet of polished carbon. The receiver case, which is in contact with the diaphragm, is in series with a 75-ohm telephone receiver, 22.5 v. "B" battery and a 400-ohm potentiometer as shown.

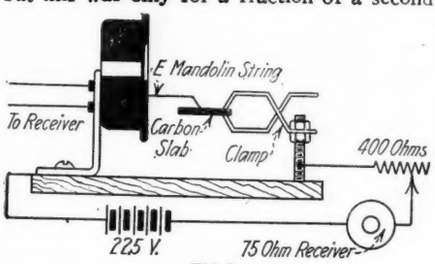


FIG.2

Another Method of Amplification Using the Microphone Principle.

VARIABLE GRID CONDENSER TYPE

In this type the author went quite a distance off the beaten track and constructed an amplifier which deserves lots of attention on the part of experimenters.

This type offers lots of room for improvement, which can easily be brought about in due course of time. By referring to Fig. 3, you will note that a variable grid condenser has actually been constructed in the receiver itself. When the incoming signals vary the position of the diaphragm nearest it, the distance between the two condenser plates are varied.

The second audion circuit is a peculiar one. It must be arranged so that the iron core transformer feeds back into the grid-filament circuit, causing the bulb to howl, squeal, etc. The filament is adjusted to the point where the tube is on the verge of squealing. The incoming signals varying

(*Continued on page* 664)

A Relay Key

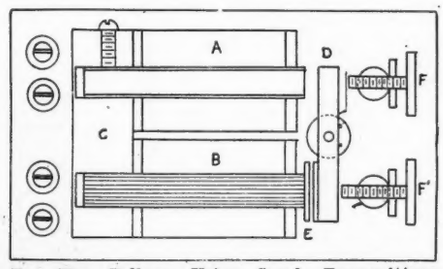
By PAUL G. EDWARDS

THE apparatus, as shown by the skeleton drawing, consists primarily of two magnets, A and B, mounted in a hard-wood block, C. These two magnets are connected to a hand key, vibroplex, or other means of excitation. Their windings can be either in series or multiple, the former method requiring less auxiliary current, the latter being speedier in action, and their dimensions, too, and size of wire are determined by the local current available.

The core of magnet A is a solid iron rod of medium hardness, encased in a *copper* tube. The core of B is of laminated soft iron strips. The core of A must be made adjustable longitudinally by means of the blunt pointed wood screw as shown. The end of the laminated core of B is filed true, and to it is sweated a heavy contact, shown at E, which is met by a similar contact on the iron armature, D. These contacts should be of coin silver, two dimes being excellent. The very greatest of care should be taken to align them properly before soldering. Any slight unevenness resulting can be removed with a thin flat file after the instrument is completed. It is vitally important that this phase of the work be carefully done.

The armature, D, is supported before the two magnet cores by a steel pin set in a short section of brass rod. It is necessarily square in cross section, and carries a light brass spring pinned on either side of the center.

Two steps, F and F¹, equipped with locknuts and held to the base with screws, meet the armature and spring respectively. The remaining set of connections is brought, one to the core of magnet B, and the other to the armature by a small piece of flexible lamp cord not shown in the illustration. It should be soldered near the axis. Connection should not be made to the armature supporting post, as this arrangement is not satisfactory for the high amperage the key is designed to carry. A condenser of about ½ mfd. should be shunted across the contact binding posts to absorb the spark. This completes the mechanical construction, the size of the various parts being left to the discretion of the builder.



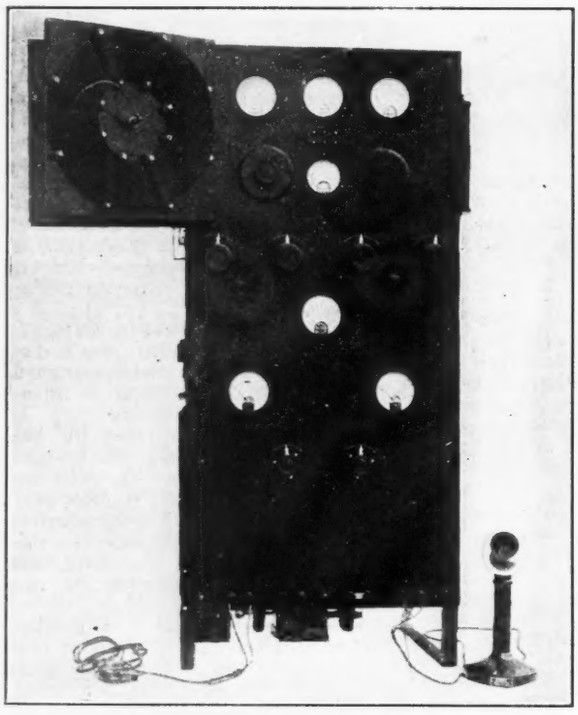
For You Fellows Using Spark Transmitters, This Relay Key Should Have Some Interest, for You Can Build One Yourself.

The operation of this mechanism is dependent upon the peculiar construction of the cores. When an impulse from a hand key or vibroplex actuates the two magnets A and B, in series or multiple, the laminated core of B builds up magnetism quickly and closes the contacts at E, while the copper sheathed core of A is slow to magnetize, and fails to attract the armature until it is already held by magnet B and out of range. When the current ceases to flow through the magnets, the laminated core loses magnetism readily and releases the armature almost instantaneously, while the copper sheathed core loses magnetism slowly and pulls the contacts apart with a much quicker break than could be had using spring release alone. Practically the sole purpose of the spring shown is to prevent vibration of D when in "open" position. The core of A should be adjusted so that it does not

(*Continued on page* 636)

The C.W. Transmitter at 1AFU

By F. C. ESTEY



This Type of C.W. Set, Although of Amateur Make, Has a Commercial Like Appearance. It is of Good Design and Should Appeal to Those Who Intend to Build an Efficient Transmitter of Medium Power.

ENTERING the radio room, directly opposite the door is the panel transmitter and to the left of this is the control switchboard carrying the 110-volt city power lines with volt meter and ammeter and switches for throwing the 110-volt line onto the high voltage transformers and the filament heating transformers; there is also a switch for throwing this current onto the battery charger, and a combination plug so that an electric soldering iron or portable lamp can be plugged in without disturbing the lights in the room. There is also a special Dubilier protective device on the back of this switchboard, and all of the wiring to and from this board, as well as the wiring in the radio room, is in B. X. cable.

Running at right angles to this table is another that has the receiving set, the changeover switch and key; the operator sits so that the receiving set is directly in front of him and the control switchboard and transmitter are at his right, while at the left an Underwood typewriter swings out, for copying . The receiving set consists of a short-wave with coupler and variometers on the bottom of a 10" x 15" panel, while at the top a three-coil mounting and two Clapp-Eastham balanced condensers are used for long waves with two anti-capacity switches for changing the antenna condenser from series to parallel and long to short waves, another panel 10" x 15" contains a detector and three-stage amplifier.

Under the bench containing the transmitter is the aluminum rectifier and the high voltage plate transformers, also the battery charger and the storage battery for the receiving set.

Aerial and ground leads running in the station are of copper ribbon supported on electrose insulators; a pair of Baldwin receivers completes the station and the only noticeable noise when transmitting is the click of the key.

THE C.W. TRANSMITTER

Naturally the first thing about the transmitter is the panel and if bakelite was given as a prize with every audion tube, we would all use inch thick panels; however, the cost of the panel will not be the only thing to consider, as cutting out the many meter holes means a lot of work and the thinner the panel the easier it will be to work it. A panel 19" x 38" was used in this set without any too much room, one-quarter inch bakelite is thick enough, if properly supported.

No holes for meters and other instruments are made until everything going on to the panel is drawn thereon with a lead pencil; it is much easier to erase or move a pencil mark than it is to try to change a hole already cut into the panel. Five holes are drilled through the panel, equally spaced on each side, 1" in from the edge, also one hole in the top and bottom 1" from the edge and in the center of the panel.

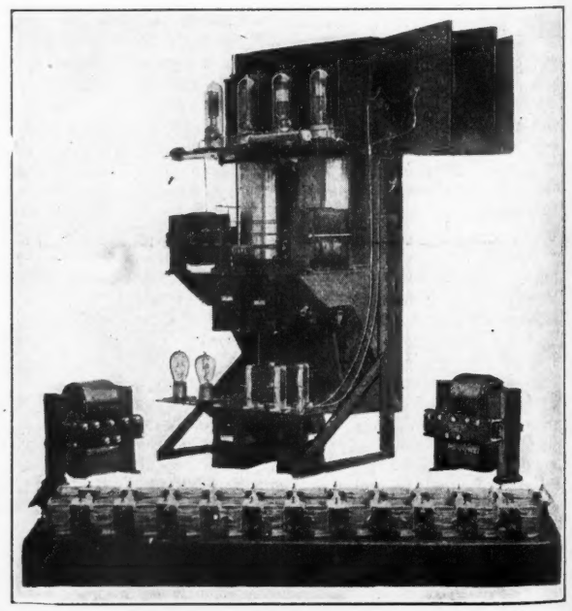
A frame of wood 3" wide and 1" thick is made, 18" by 37", and 12" from the top, also 12" from the bottom another piece is put across this form like a partition. The panel can either be screwed against this or an insulator used as a spacer between the panel and the frame under each screw. The latter is the better way, because it leaves a space for any wires running up or down the panel without having to drill through the shelves or partitions. An angle iron frame with legs 18" long will support this panel 6" above the bench and will make sufficient base for the set. This frame is screwed to the wooden frame.

Three bakelite shelves can now be cut to fit onto the two partitions and the bottom; it may become necessary to cut out wood braces to put under each shelf, as shown in the picture, or, wooden shelves can be used. The four-tube bases are mounted on the back edge of the top shelf, together with the grid leak and grid condenser and a small safety gap for each tube. The grid relay with one mfd. shunting condenser is also put on this shelf and as the relay is set up to about a 1" movement, there will not be jar enough to bother the tubes. On the panel directly in front of this shelf is the radiation meter, the plate milliammeter and the grid milliammeter are set in place also the tuning inductance and tickler coil. These are both of pancake type and hinged to the front panel like the oscillation transformers used on spark sets; this inductance is made up of 25 turns of ½" x 1/32" copper ribbon wound in slots cut into eight pieces of ½" x ½" bakelite, 3/16" is left between turns. Both inductances are the same.

On the middle panel the two Acme 150-watt filament heating transformers are placed, also the by-pass condensers, two ½ mfd. and 1 mfd. On the panel is front of this shelf are the controlling knob and dials for the variable condensers and in this particular set a double pole double throw switch is used to throw in either a 0-5 or 0-10 thermo couple ammeter. Four rheostats are used, one for the filament of each tube. This is absolutely unnecessary because a rheostat in the primary side of the filament heating transformers is now used and is to be recommended.

On the lower shelf the filtering condensers, the two 1½ henry double choke coils, the modulation transformer and five-watt tubes are mounted, also the filament heating and plate transformer for the two 5-watt speech amplifier tubes. The gril chopper is mounted on the wall directly behind the top shelf; this is done to avoid unnecessary vibration in the tubes.

Two plate voltage transformers and the

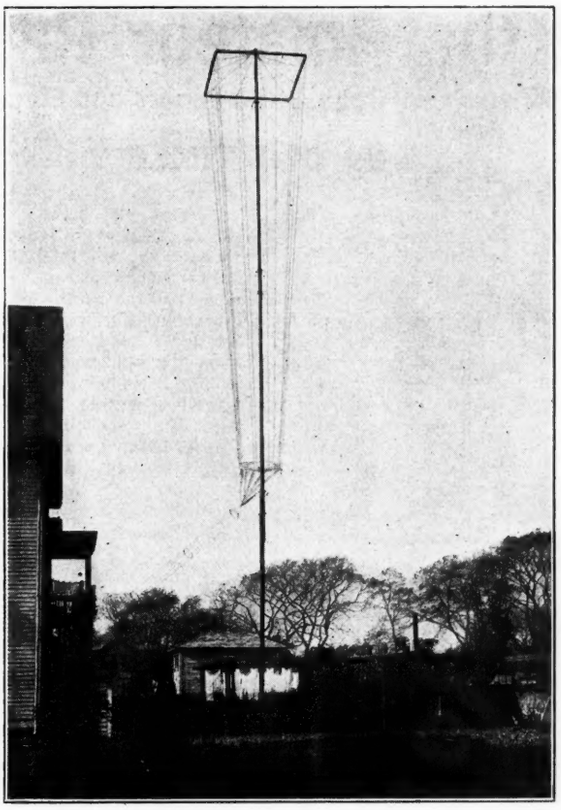


Here is the Complete Transmitter, Including the Transformers and Electrolytic Rectifier In the Back View of the Panel May be Seen the Four 50-Watt Tubes.

rectifier leave the necessary materials for such a set complete, except for the filament voltmeter and filament ammeter and binding posts, which are mounted in front of the bottom shelf together with the filament control rheostats for the five-watt tubes. Two anti-capacity telephone switches are also installed for changing from phone to C. W., but the set will not be used as a phone until after the Transatlantic tests.

The rectifier is the thing most people have trouble with and the trouble usually is that they buy just plain aluminum and get an alloy which never really works properly; care should be taken to secure pure aluminum (at least 99%) sheet, $\frac{1}{16}$" thick, and cut it into strips 1" wide and 6" long; bend back one end 1" at right angles, but drill a $\frac{1}{16}$" hole through it first, $\frac{1}{2}$" from the end. Cut and bend the necessary number of lead strips the same way, 24 of each are enough. Forming these is a costly and hard job for the inexperienced and the writer is one of them; however, previous experience with aluminum taught me that it has a very high resistance surface and this should be removed, accordingly a cup of potash was dissolved in two quarts of boiling water and a little ammonia and a few drops of vinegar were added, making a solution that will eat off this surface in about two minutes. Drop the aluminum pieces in, all at once, and after a few minutes run hot water into this until they are thoroughly rinsed.

By taking one lead and one aluminum and putting an 8/32 screw through the hole in each and putting on a nut, the section, or element, for each pair of jars is neatly assembled as shown in the photo. Then 24 one-pint preserving jars are fitted into a rack and into these is poured a solution of borax and water, as much borax as 15 quarts of water will dissolve, or a little less than two pounds. Let this thoroughly settle before filling the rectifier jars and then turn on the voltage from the plate transformer. 30 amp. fuses will not hold, unless a heavy resistance is used in series with the supply lines; the plates will gradually form by decreasing the resistance until finally two transformers in parallel will only draw two amps. When not loaded, in putting two transformers in multiple, care must be taken as the primaries are not always wound in the same direction, and after the primaries are in multiple, trouble may be experienced on the secondaries. My plate transformers have the primary leads crossed and secondary leads parallel, while the filament transformers are the reverse.



The Aerial at Station 1AFV is of Unusual Design and is Well Adapted for C.W. Work. The Disposition of the Wires is Ideal and Gives Maximum Radiation in the Aerial Counterpoise Circuit Used with the Set Described in This Article.

The two Clapp-Eastham variable condensers are standard laboratory type except that they were taken apart and two spacing washers used between each plate; this will also require special cases and will reduce their capacity to one-half, but after they are immersed in oil they will come back to about .0025; one is used in the tickler circuit and the other in series with the aerial.

Once this set is finally assembled and ready to try, it is a good idea to drive everyone out of the station and tune alone. Use only one tube and low plate voltage until radition shows on the required wave. Once the point is found where the set starts radiating, adjusting will show what needs changing better than the experience of any one set will show. The tickler condenser is very critical in adjustment and the plate tap is also critical.

In the first week of operation the following stations have been worked: 1AW, Hartford, Conn.; 2FD, New York; 3ZA and 3AQR in Pennsylvania; 3MO, Richmond, Va.; 4BY, Savannah, Ga.; 8UK, Cleveland; 9WA, Owensboro, Kentucky; and 9AJA, Chicago, Ill. How many have heard the station is not known, as the call letters are not listed, and only two tubes have been used with a radiation of only seven amps. on a thermoammeter.

THE ANTENNA

The fact that most of us are cramped for space to build just the kind of an antenna we would like, is excuse enough to justify the writer in building this one. The good old days of FBD, when I had two masts 120' high and 350' apart, are all over for two reasons, first, such an aerial would be useless on amateur waves and second, most of us have not enough land available on which to put an antenna.

In constructing this aerial, a high center of capacity was the principal object and a yard only 72' square was a condition of affairs that had to be faced. Located in the residential section of the city, about three minutes from the center, it was necessary to construct something that looked fairly good, or the neighbors would kick. Wishing to build a two-stall garage, this with a radio station, would use up much of the yard space.

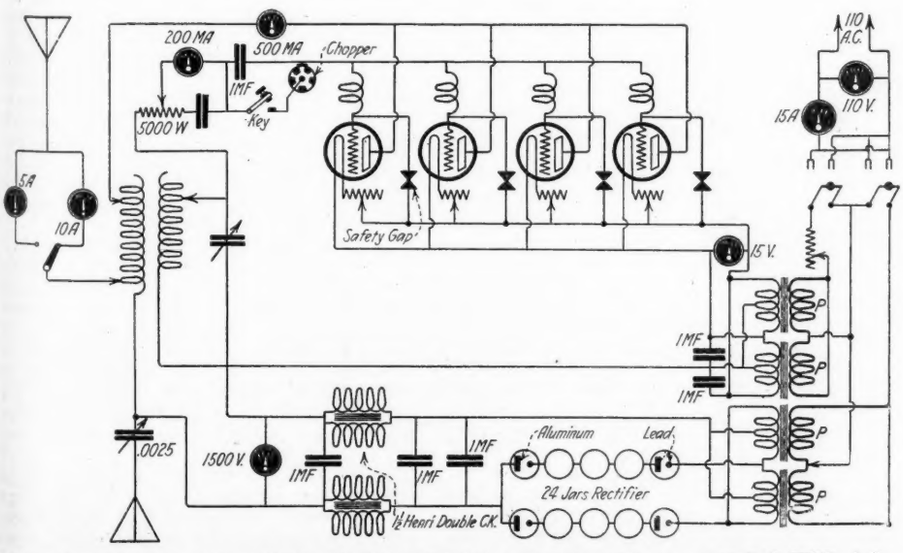
The mast is built in three sections each 27 feet long; the lower section is 4' x 4' and the middle 3' x 4", while the top is 3' x 3'. Four posts of 4" x 4" are set into the ground at each corner of the yard, and back guyed to a 6' harpoon guy anchor. The first thing to do after securing the necessary lumber is to get some waterproofing compound and thoroughly treat each piece, and while waiting for this to dry, it is a good idea to cut the guy wire up into 15' lengths and put in strain insulators, making up each guy wire to the required length before starting to raise the mast.

Straps are the best proposition for holding the various sections together and these same straps, when properly made, make an ideal place to attach the guy wires. Take some 1½" x ½" strap iron and cut each piece 3" longer than the width of the mast; four will be needed for each joint and two for the top of the mast and two more to hold the top set of guys.

One-half inch from the end of these straps a hole about ⅜" in diameter and thoroughly countersunk on both sides should be drilled, for attaching the guy wires; two holes $\frac{9}{16}$" in diameter and drilled on centers ⅝" more than the width of the mast will give holes for two ½" machine bolts for clamping the sections together. The only other drilling, and this is not absolutely necessary, will be two $\frac{3}{16}$" holes, about 1" from the edges of the mast and when each section is in place a small spike can be driven in, which will prevent the sections from slipping when under strain.

The spreader at the top of the mast is made of four 10' lengths of copper conductor pipe; four 3" ells are also used on the corners. After the square spreader is assembled the joints should be soldered; the spreader is 11' square when assembled with the ells. This gives all the material excepting the bottom hoop, which is made of ½" copper tube about 3' in diameter, and where each wire is attached the hoop is flattened out and a hole put through to take

(*Continued on page* 626)



Complete Hook-up of Mr. Estey's 200-Watt C.W Set. The Filaments Are Supplied With A.C. and the Plates With the Same Current, Stepped Up and Rectified.

Blazing the Amateur Radio Trail

Memories of By-Gone Days When Spark Coils, Slide Tuners and Electrolytic Detectors Were in Style

By OLD TIMER

TAKE away the present radio laws, licenses, vacuum tubes, simple tuning apparatus, radio telephone and a few other characteristics of present-day radio and you are back to the pioneer days of radio. In time, it is but a dozen short years, but in wireless history it is an age, punctuated by a number of epochs or eras marking the wonderful development of the greatest hobby of all time.

My first contact with radio was during the first electrical exposition in New York City. The center of attraction was the exhibit of the Marconi company, consisting of two simple stations for sending and receiving messages back and forth across the wide floor of the old Madison Square Garden. Each station, which was mounted on an ordinary table, comprised a ten-inch spark-coil, a key, the necessary primary current supply, a magnetic detector, and a pair of telephone receivers, not to mention the huge aerial and the ground connection. Each station was in charge of a fastidiously dressed young man, with a very, very sagacious look. A buzzer would have been sufficient to span the short distance between the two stations, but then why use such an unimpressive device as a buzzer? The crashing purple sparks, jumping the large spark-gap, never failed to attract a large crowd of inquisitive persons. For that matter, the operator at either end could read the signals by the noise of the other operator's spark gap—but I must not give away such secrets. It spoils the whole effect, does it not?

At any rate, that was my first encounter with radio, and whether it was the sagacious and contented looking young men or the purple sparks that did it, I do not know; but from that time on I became a confirmed radio enthusiast.

Somewhere I read about Marconi's early experiments with a coherer, and I immediately proceeded to construct one with a piece of glass tube, two solid silver wires, a couple of binding posts and an old box as a base. Not realizing the importance of a relay, I placed the coherer in circuit with a simple bell, arranged as a decoherer. The aerial consisted of one of the household pie tins, hanging at the end of a ten-foot wire that dangled from the fire-escape in a city apartment.

Everything being in readiness, the great moment arrived. The whole family gathered about to hear the wonderful wireless messages. For one hour nothing happened, and one by one the members of the family drifted away to less interesting but more positive forms of diversion. Suddenly, thanks to constant coaxing, the bell began to ring. It was a signal, no doubt. The decoherer did not perform its function, so it had to be jollied along. But each time the coherer was restored to its passive state, the bell would again ring. Surely these were signals.

Not Realizing the Importance of a Relay, I placed the Coherer in Circuit With a Simple Bell Arranged as a Decoherer. Then I discovered That Each Time My Neighbor Used His Hammer the Coherer Went Off. Hence My First Radio Messages Were Nothing More Than Hammer Blows.

All the while I had failed to hear the loud hammering going on in an adjacent room, until finally it dawned on me that this radio outfit was a pretty sensitive affair after all, and that even a light tap on the box made it set off the bell. Then and there I discovered that each time my neighbor used his hammer, the coherer went off. Hence my first radio messages were nothing more than hammer blows.

A short time later I went to the old carbon grain coherer, with which I soon succeeded in obtaining audible signals by means of a single 75-ohm telephone receiver. If nothing else, the carbon grain coherer was the means of obtaining loud signals from nearby stations, but it did not bring in the stations outside of a 25-mile range.

Things progressed rapidly in radio, even in those early days. By 1908 we were all using electrolytic detectors. Most of us made our own. We purchased a short length of Wollaston wire—platinum wire with a silver coating—which we placed in a short length of glass tubing. The glass tubing was then placed in a Bunsen burner flame and heated to a bright red, so that the plastic glass could be slowly drawn out at the point where the wire lay. Then the glass tube become two pointed pieces of glass tubing, and the wire was firmly embedded at the fine tip of each piece. The next step was to cut the wire and take each piece of glass tube and grind the point on an oil stone, until the wire was absolutely flush with the ground glass surface, thus exposing only the actual cross-sectional area of the wire.

The electrolytic detector then consisted of a simple cup holding the electrolyte, generally consisting of one part of nitric acid to four or five parts of water, and the glass-encased wire dipping into the former. A very delicate potentiometer control had to be used for the local battery current passing through the telephone receivers and the electrolytic detector. The action consisted simply of the decomposition of the electrolyte under the battery current flow, resulting in the formation of a thin layer of gas which finally insulated the delicate point and prevented the further flow of current. However, with the reception of signals the induced current caused the thin layer of gas to be perforated, and restored the flow of current momentarily, only to have the gas again form and the current shut off. Obviously, the telephone receiver gave an audible indication of this action, thus resulting in audible signals.

There was another type of electrolytic detector in which a bare platinum or Wollaston wire was employed, barely dipping in a solution held in a carbon or platinum cup. At any rate, the electrolytic detector, back some dozen years ago, was considered the very last word in ultra-sensitive radio detectors.

For transmitting, we amateurs of those days employed anything in the way of a spark coil, ranging from an old jump spark-coil that had seen service in an automobile, to a ten-inch spark coil of the home-made construction, soaked in an oil bath. For my part I made use of a 3-inch coil and a large number of dry cells. Soon, to my dismay, the dry battery died down to nothing, for that 3-inch coil seemed to have an insatiable appetite for current. So I resorted to an electrolytic interrupter and the house lighting current. The electrolytic interrupter consisted of a piece of heavy glass tubing in which was sealed a piece of heavy platinum wire. This interrupter was placed in series wth the induction coil primary and the source of current. The spark coil produced a hot, flaming spark when operated in this manner; and with the proper arrangement of inductance and capacity, some 25 miles could be covered with little trouble, even in those days when receiving sets were anything but sensitive. The only trouble was that the interrupter had a way of breaking down right in the middle of a message, due to an excess of heat which caused the glass tube to crack or even melt. And then the fuses! Time after time the house lights would go out as the consequence of the interrupter's pranks.

The comradeship of radio in those days was quite marked. There were no radio laws, and we did more or less as we pleased. True, there were leaders among us who constantly warned us of the certainty of severe legislation if we continued to act as we pleased. An amateur might decide to work on 600 meters or 200 meters, as his fancy dictated. Or again, in most cases he did not know what he was operated on and cared still less.

One evening I received a call from an amateur but a mile away. He asked me what power I was using, and seemed surprised at the loudness with which I came in. He invited me to call and see his outfit

(*Continued on page* 640)

The Fable of the "Ham" and the 4KW

WITH APOLOGIES TO GEORGE ADE.

By CHAS. K. FULGHUM

He closed the switch and pressed the key * * * Just what happened he never knew, for by the time the family smelled the burning rubber, he was probably taking out his harp check.

ONCE upon a Time there was a "ham," and he was the "hammiest" "ham" that ever Was; for he Isn't now. His name was Alfred.

From the First, everyone Knew that he was Cut out to be Something, the Opinions of what it was Varied. Mamma said that He was a Genius and what the Neighbors said can't be told on these pages.

Alfred was a Born Scientific Investigator from the Start.

Mamma used to tell at the Club how Alfred was Fond of Watching the Lightning. Personally we think it was Wonderful how he ever saw It. At the Mere Mention of Thunder, Alfred would Exhibit a sudden Fondness for Hide and Seek in the Vicinity of his mother's Bed; with due Emphasis on the Hide.

The Family Cat could also tell of Experiences such as being used as a Static Machine with Attempts made to light the Gas. The Experiment was never Successful.

All in All, Alfred was a Wonder.

More than one Family Discussion took place in settling the Source, and it was usually Hung Up to Mamma's Ancestors. Father as a rule Fought Shy because there were some of the Boys who remembered that at one Time he had Sold Oil Stock.

Now when Marconi first found that the Ether would allow a few Watts to be Dumped into it without Protest, Alfred was of little consequence to the Census Taker.

But when he began to Comprehend, the family limousine was Minus a Spark coil and the Telephone suffered similar Ravishes.

After the Discussion that Followed, which ended with Father in a Corner, it was decided that Alfred needed an Allowance to Enable him to continue his Experiments. Alfred had known this all along, but it took Mamma to Bring home the Bacon.

Now it Happened that about the Town there were several other Fellows who read the Papers, and it is a well-known Fact that Radio is Contagious. Thus when Alfred's neat little Two-inch split the air, there were others of perhaps not as Nice a Finish who also Buzzed and Sputtered and made things Nasty for our Hero when he wanted to listen to Arlington. Mamma even Called on some of the Boys' mothers to see if they could not find another time to Fool with their Wireless. While she did not get the Cold Shoulder, she was not Assured of Clear Air for her Son to put his Antenna into.

When the Boy around the corner, who had always spent his Evenings at the Library, began to run up the Family's Light Bill, with a quarter K.W. transformer, Alfred's parents called a Directors' Meeting and it was but a few days when the Power company had another source of Burned out Meters to look after. Alfred thought that Kick-back was what a mule did.

To Mamma the whole Situation was one of Alfred trying to Revolutionize the whole Radio World, and at the same time Bucking the whole Gang alone.

In order that there might be a more general Spread of the Knowledge of Radio, the Gang Organized and Alfred was asked, with many Forebodings, if he would Join. It was Discovered that Alfred did not care to Affiliate himself in any way with the Club.

Plainly he was Running on his own Hook.

As time progressed, the Club grew and

(*Continued on page 674*)

Over The Wireless Phone

A Play in One Act

By ERALD SCHIVO

MRS. GRAY, a beautiful young wife
MR. GRAY, her husband
QUEENIE, their baby, recently born
SCENE: Mr. Gray's den
TIME: The evening

(*When the curtain rises* MR. GRAY *is sitting before a wireless set manipulating his radio telephone. His baby is crying in a cradle situated in a remote corner of the room. Enter* MRS. GRAY *with hat and furs on.*)

MRS. G. (*removing her furs and speaking coldly*)—Well?

MR. G. (*rising quickly from his chair*)—Back so soon, dear?

MRS. G. (*angrily*)—Didn't I tell you to prepare the dinner? I return to find the baby crying and you giving her no attention whatsoever. (*She begins to sob.*) Will you ever think of anything else but that horrid wireless set?

MR. G. (*contritely*) — But, de——

MRS. G. (*interrupting*) — Never mind making excuses. You were about to tell me that it is a great study. (*Goes over to baby and gives it a pacifier.*) The poor darling. She'd die if I left her with you long.

MR. G. (*pleadingly*)—Now, Gerty, please——

MRS. G. (*interrupting*) — Stop calling me Gerty! (*A tear rolls down her cheek.*) I know now why you are so interested with this wireless telephone set of yours. (*Points to the apparatus.*) Mrs. Smith across the street told me everything!

MR. G. (*wonderingly*)—Everything?

MRS. G. (*removing tears from eyes with handkerchief and assuming a haughty attitude*)—Yes, everything. You are no gentleman, Harry, and I will not stand for it!

MR. G. (*dazed*)—I don't know what you mean.

MRS. G. (*slowly*)—No? Liar! Hundreds have no doubt heard you speaking over that perfectly innocent looking wireless set to another woman! And the things you said! (*Points to the baby.*) In the presence of my darling, too.

MR. G. (*curiously*)—And what were some of the things I said?

MRS. G. (*bitterly*)—Do I have to repeat the very words you spoke to her? My God! You know quite well what you said to her. (*Tears.*)

MR. G. (*sternly*)—Come now, Gerty, get over this foolishness and stop the crying. Mrs. Smith has told you a falsehood. I have never spoken to any women over this phone.

MRS. G. (*after pausing*)—Don't lie to me, Harry. Your voice was heard by Mrs. Smith with her son's wireless receiving set, and you were talking to a woman.

MR. G. (*puzzled*)—And when did this conversation between myself and this other woman occur?

MRS. G.—This very afternoon. I stopped in Mrs. Smith's home before coming here, and she told me all that you said.

(*Continued on page 664*)

Never Again Will I Talk Over This Telephone to a Young Lady When My Wireless Phone is Also Transmitting My Voice.

Junior Radio Course

RADIO CONTROL

Part III

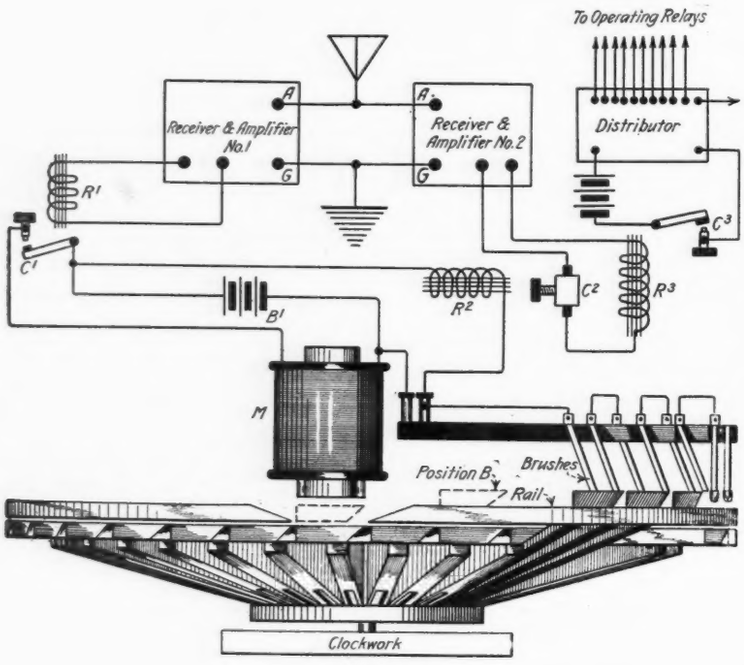


FIG.1

This device, which may be called a "radio lock", prevents the radio controlled craft from being operated accidently by signals sent on its operating wave-length. Its function is to open or close the circuit of the radio control system at the will of the operator; it is operated by a special combination of dots and dashes.

IN Part II of this lesson, published in the December issue of this magazine, was described a Radio Control System and its operation. The apparatus described here is the complement of this radio control device and consequently we shall not go into further details about the system itself.

As was mentioned in the last lesson, any radio controlled apparatus may be operated accidentally by some signals sent on the same wave-length as the one used for the control, and unless a special safety instrument is used, the ship, aircraft or car operated by radio may get beyond the control of the operator without him knowing it. To prevent this, a very clever instrument that could be called a "radio lock" has been designed to be used with the same radio control apparatus described previously.

Thanks to this instrument, the craft operated by radio from a distance, cannot be affected by other signals than those sent from the transmitting station controlling it. It functions on the following principle: In normal times the connections are such that the circuit of the relay controlling the distributor is open, and can be closed only when the "radio lock" closes the circuit, the latter being operated on a different wave-length and only by a certain signal which may be any letter of the Morse code. Supposing a ship is equipped with the radio control system already described, and the "radio lock" which we shall describe later, it is necessary for the operator controlling the ship from the shore to send first a certain signal on a special wave-length; this closes the circuit of the radio control which may be then operated as explained in the last lesson; this being done on another wave-length. The "radio lock" is then closed by the same signal sent on the special wave-length used for this purpose, opening again the circuit of the relay controlling the distributor which cannot be disturbed by any signal sent on the operating wave-length.

THE "RADIO LOCK"

The "radio lock," of which we just spoke, is shown in Fig. 1 connected in the circuit of the radio control system installed aboard a ship. As may be seen, two receivers and amplifiers are used, connected to the same aerial, the receiver No. 1 operating the "radio lock" being tuned on, say 700 meters and the receiver No. 2 operating the radio control system, being tuned on another wave-length, say 900 meters. The lock itself in this case is operated by the signal . . — sent at a certain speed, automatically by an instrument of the same type installed at the transmitting station and rotating at the same speed as the "radio lock" system.

The details of construction of the "lock" are shown in Figs. 2 and 3, Fig. 2 illustrating the side view of the arms mounted on the rotating shaft and Fig. 3, the plan view of these arms. The whole structure of the instrument is made of aluminum or brass with, mounted at the end of each arm, a piece of iron which may be attracted by the magnet M, placed above the gap in the rail when a current flows through its winding. On the top of the instrument are mounted some insulating pieces supporting two brushes each. These pieces may be adjusted in any position so as to make the apparatus respond to any signal. Over the iron pieces mounted at the end of each arm, is fixed close to them a rail cut at one point as shown in Fig. 1, so as to form a gap with an inclined sliding surface onto which the armatures can slide up to position B, Fig. 1.

The set of arms is constantly rotating at a certain speed and may be run either by clock work or electric motor. If a dot is

(*Continued on page* 650)

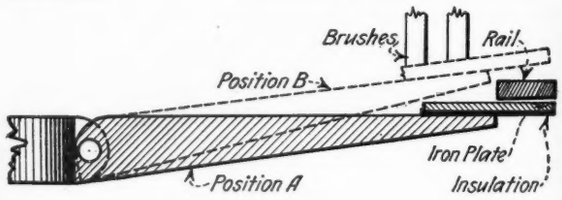


FIG.2

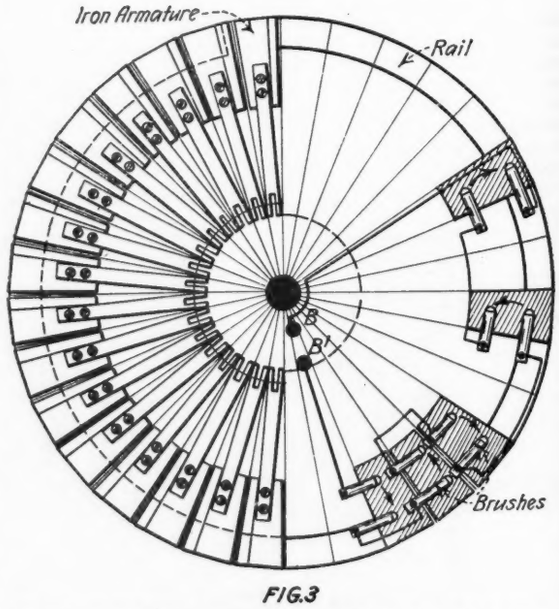


FIG.3

In Fig. 2 is Shown How the Iron Plates Supported by the Arms Make Contact With the Brushes When Sliding Over the Rail. Fig. 3, Below, Shows, on the Left, the Mounting of the Arms on the Shaft, for Clearness Only Part of Them is Shown; While on the Right it May be Seen That the Iron Armature Must be Attracted Above the Rail in a Certain Order to Close the Circuit Between the Binding Posts B B1. Note the Arrows Showing How the Circuit is Completed.

That $1 Radio Set

By ROBERT E. LACAULT

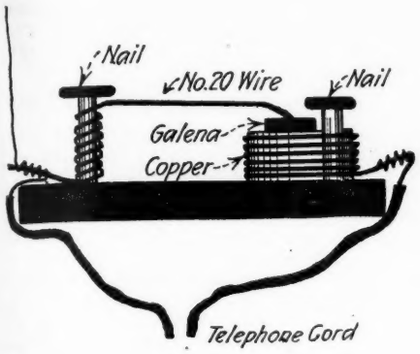


FIG.1

This Crystal Detector May be Built for About Fifteen Cents and Will Give as Good Results as Any Other Type if a Sensitive Piece of Galena is Used.

THE broadcasting of radiophone concerts has been given a wide publicity in the magazines, as well as in the daily press, and several persons who never before had read any details about Radio and its possibilities, have become interested in it, and would like to know how these concerts can be received. Most of those who do not know anything about Radio are struck, when opening a Radio magazine, by the variety of equipment advertised, and especially by the prices; several of them then become discouraged and do not push further the idea of buying a receiving set.

For these persons, we shall give in this article a little practical data for making a home-made receiving apparatus, which will cost about $1. Of course, the efficiency and sensitivity of such a set cannot be compared to the modern types of receivers which are now obtainable, and in which vacuum tube detectors and amplifiers are used, but very good results may be had with such a cheap outfit, provided the directions given in this article are carefully followed.

To build this small receiver the main things to secure are a good telephone receiver, which may be bought very cheaply in a second-hand shop, and a mounted crystal of galena, that is, a piece of galena inserted in a little block of lead; this may be bought at any Radio supply house for a few cents. Or else a 50c "Rasco" Detector will do.

The home-made detector may be built very simply, as shown in the sketch, Fig. 1. Two nails should be driven into a piece of wood used as a base and the mounted crystal tightly secured to one of the nails by a tight winding of copper wire fixed around both. The exploring wire, better known among the amateurs as the "cat whisker," consists of a piece of the same wire wound around the other nail, as shown, and bent so that its tip lays down on the crystal with a certain pressure; this end of the wire should be sharpened with a nail file, so that the tip is about as sharp as a pin. About 2" of the wire from both nails should be left out to make connections with the outside circuit.

THE ANTENNA

The antenna to be used with such a receiving set may be of several types, according to the space available for the erection of the wires, which compose it. If in the open, the simplest type of antenna to erect is a single wire about 150' long, attached as high as possible between trees, houses or other natural supports which may be at hand; at each end of the wire, an insulator should be fixed and may consist of a piece of dry wood about 10" long, or preferably, of two porcelain pulleys. These insulators are then inserted between the string fixed to a nail and the wire itself, as shown in Fig. 2.

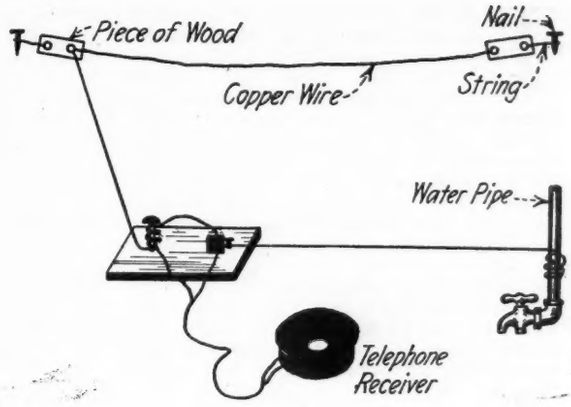


FIG. 2

With This Little Receiving Set Radio Telegraph and Radio Telephone Signals May Be Heard. It Consists of an Aerial, a Crystal Detector and a Telephone Receiver.

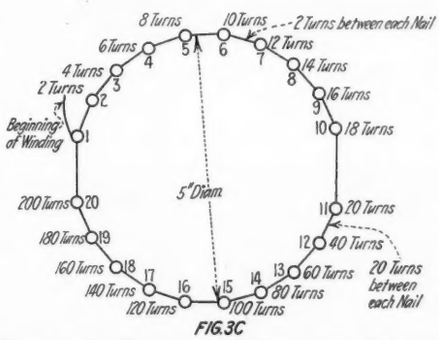


FIG.3C

Showing the Details of Winding of the Tuning Coil.

Almost any kind of wire may be used for an antenna and either insulated, bare, or enameled wires are quite suitable, provided they are strong enough not to break when stretched; No. 18 or 20 B.S. is quite suitable. If the set is to be installed indoors, the wire should be well insulated where it enters the house and it would be advisable to use a piece of rubber covered cable, as employed in motor cars to connect the spark plugs.

If in a town or other place where it not possible to stretch a long wire between trees or poles, a greater number of shorter wires may be used, but it should be remembered that the higher these wires are erected the better. If only a small surface, such as a roof, is available for the installation of the antenna, four or five wires parallel to each other and about 2' to 4' apart, will make a good antenna. They should all be connected together at one end and the connections soldered, if possible; from this end the "lead in," that is the wire carrying the current to the instruments, comes down into the house. See Fig. 5.

Another case is that if it is impossible for one reason or another to install an outside antenna, an indoor one may be rigged up and may be of the same type as the last one described. Of course, the efficiency of such an antenna is rather poor with a crystal receiver, but some results may be obtained if the receiver is not too far from some transmitting stations. With an indoor aerial composed of four wires 35' long and using the inductance described in this article, the writer receives the Radiophone transmissions from W. J. Z. eight miles away.

THE GROUND

The ideal ground connection is a large surface of zinc or copper plates buried in damp ground, about 2' or 3' deep. Another good ground may be made with long wires buried in the same way. These grounds are only possible for the fellow in the country, but for the city dweller, the only possible grounds are the water pipes or the radiator system. In any case, the preference should be given to the water pipe, but if it is impossible to reach it with a rather short con-

(*Continued on page* 669)

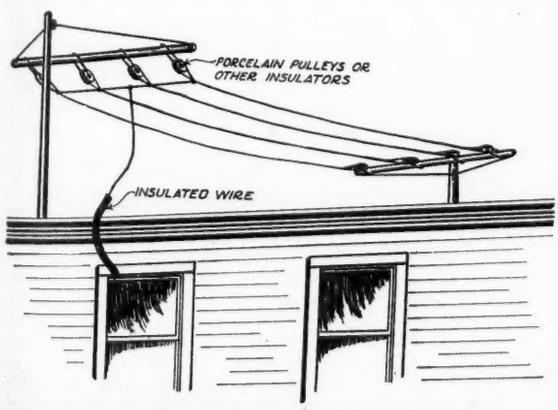


Fig. 5. If You Can Install Such an Aerial on Your House. Very Good Results Will be Obtained With the Simple Outfit Described in This Article.

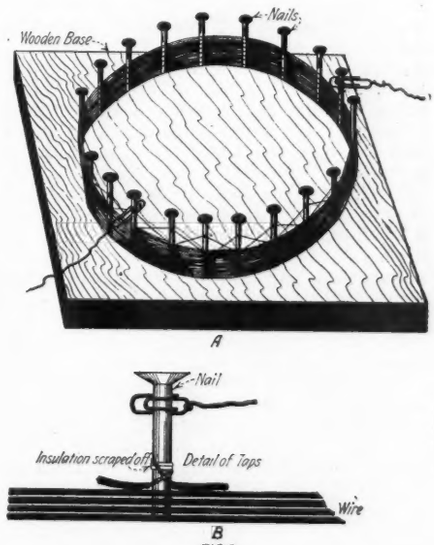


FIG.3

This Tuning Coil Will be a Useful Addition to the Set, for With it the Circuit May be Adjusted so as to Receive Stronger Signals.

The French Coast Station System

By J. BRUN*

THE two first Coast stations installed by the French Post Office Department were erected at Usshant and Porquerolles; these two stations were built by the French Navy and turned over to the Post Office Department in 1904. Little by little some other stations were added by the Post Office Department itself, completing the system along the various Coasts. In 1910 was opened at Boulogne the first Radio Compass station of the Tosi-Bellini system, which proved to be very efficient and rendered great service for the location of ships in the Channel. This station is equipped with a 1-kw. and a 5 kw. spark set, the 1-kw. transmitter being connected to the directional apparatus so that transmission may be effectuated in a certain direction.

The antenna system of this transmitter consists of two closed circuits installed at right angles and supported by high towers, these circuits being completed inside of the station by a few turns of cable mounted on a frame, the two windings being at right angles and in parallel with the outside wires. The oscillating circuit is a coil which can revolve inside of the frame and which may be turned in the direction where it is desired to send maximum energy. This is clearly shown in the photograph representing the inside of the Boulogne station during the early experiments.

The Havre station, which was completed in 1914, is installed on a hill and has a power of 2 kw., another station of 1 kw. power being available in a case of emergency and for short range traffic. The aerial of this station is supported by two towers 130' high, insuring maximum efficiency for the station which is continuously working and which handles a great amount of traffic, the Havre Harbor being second of the French ports in size. The station at Usshant handles the long distance traffic with the various ships of every nationality bound for or from America as well as the direction finding work made by a special receiver installed a short distance from the station, and sends all messages to shins which could not be reached by the other coast stations when they were out of range.

The Bouscat station, opened in 1912, handles the traffic of the Bordeaux Harbor and the correspondence with the ships traveling to and from South and Central America. This station is equipped with a 1-kw. radio electric system transmitter, also a 2½-kw. and a 5-kw. set, the latter of the quenched gap type. The first station installed in the Mediterranean Sea was opened in 1907, insuring communication with all ships within a range of 450 miles, and keeping in touch with the Algerian Coast to help the cables in handling the traffic for North Africa. The station installed at Marseille is of modern design. It was opened in 1919 and is equipped with up-to-date apparatus, including a continuous wave transmitter and a quenched gap spark set. This station sends the bearings taken by the radio compass station installed on the shore a few miles away and connected by wire to the Marseille station.

The Cros-de-Cagnes station, opened in 1908, is a low power one and handles the traffic of the Nice Harbor and the messages for the ships passing through the Genoa Gulf. In the Corsica Island was installed in 1919 a modern station, of the same type as the Bouscat one, in the Harbor of Bonifacio. The location of this station is ideal and insures a very long range, enabling any ship crossing to Egypt or the Orient to be reached.

The most important station of the Post Office Department installed in Algeria was erected at Fort-de-L'eau, a suburb of Algiers. This station, which is shown in one of the photographs, keeps in touch with the liners crossing from France to North Africa. At the present time, several other stations are under construction and are being equipped with the most up-to-date instruments, including C.W. transmitters, either of the vacuum tube or the arc type.

Inspector of the French Post Office Radio Department.

VOLUME OF TRAFFIC IS INCREASING FAST

The traffic between ships and between shore and ships constitutes today one of the most important factors of the commercial exchange and without a doubt, it may be said that this service has contributed very much in increasing navigation facilities by procuring for ship owners some new means of keeping constantly in touch with their ships, and at the same time insuring the passengers against accidents, as much as is practically possible. At the end of 1920, 13,694 stations were registered at the Berne Bureau, among which 95 were land stations, 977 were coast stations and 12,622 were ship stations. Among the ship stations, 4,170 belonged to the United States; 3,754 to Great Britain, and 978 to France; while in 1913, the total was only 3,000 stations in working order, this number today is over 13,000, of which 4,500 are for the United States alone.

France possesses 1,000 ship stations and it is estimated that 300 new ones were added during 1921. The radio traffic between ships and shore has progressed as follows: In 1808 the French Coast stations received or sent 876 messages; this number grew to 33,784 in 1912, and to 42,298 in 1913. During 1920, the same Coast Stations exchanged with ships at sea 79,082 messages.

Unfortunately the traffic becomes more and more entangled owing to the fact that the International Convention of London in 1914 stipulated that all ships carrying passengers, or cargoes of more than a certain capacity, should be equipped with radio apparatus. All these stations, working on the same wave-length, produce some interference, which makes very difficult the reception of messages and of distress signals at the same time the nearby stations being so loud that they cover entirely the weak emissions of emergency sets used by ships in distress. The interference is such that, in certain Coast stations in the Channel and Mediterranean Sea, they have to relay some messages for a ship 200 miles away in spite of their 5 kw. of power and their high aerials.

THE Q.R.M. QUESTION

The only solution to the problem of radio signal interference resides in using the various wave-lengths and strict observation of the rules by all operators. It appears very often that operators only a few miles away use full power to reach a Coast station, causing unnecessary interference on 600 meters, which wave-length is already crowded by transmissions from ship to ship and from shore to ship. The system of several working wave-lengths will replace some day the unique one used at the present time and the International radio regulations will have to be modified accordingly. The French Commission, after much study, found in 1919 that it should be necessary to maintain the calling wave-length of 600 meters, and use the 800-meter wave for exchange of the traffic only, each station being able to use two other wave-lengths in case too much interference is experienced on the working wave-length. However, it would be necessary to experiment with these regulations before enforcing the rules, for the statistics show that the number of messages sent from ship to shore is ten times superior to those sent from shore to ships. At sea, the ships experience little interference from the Coast stations; on the other hand, the Coast stations experience much continuous interference, not only from the ships, but also from the other Coast stations of the same system, the latter being stronger on account of the power used by the land stations.

For instance, the Usshant station has constantly in its radius 70 to 80 ships calling it about every two hours; at night all the Coast stations of a certain power, as well as those of North Africa, produce some strong interference on 600 meters and cover the calls of some ships. It is easy to understand how difficult the work is for the operators in such a station, and to see how badly new regulations are needed. However, it is necessary in order to make new regulations effective, that the type of apparatus used be carefully considered and to favor, as much as possible, the use of quenched gap sets, as well as continuous waves. Otherwise the use of several wave-lengths, unless having a great difference between them, would be ineffective in case sharp selectivity is not obtainable.

CONTINUOUS WAVES SHOULD BE FAVORED

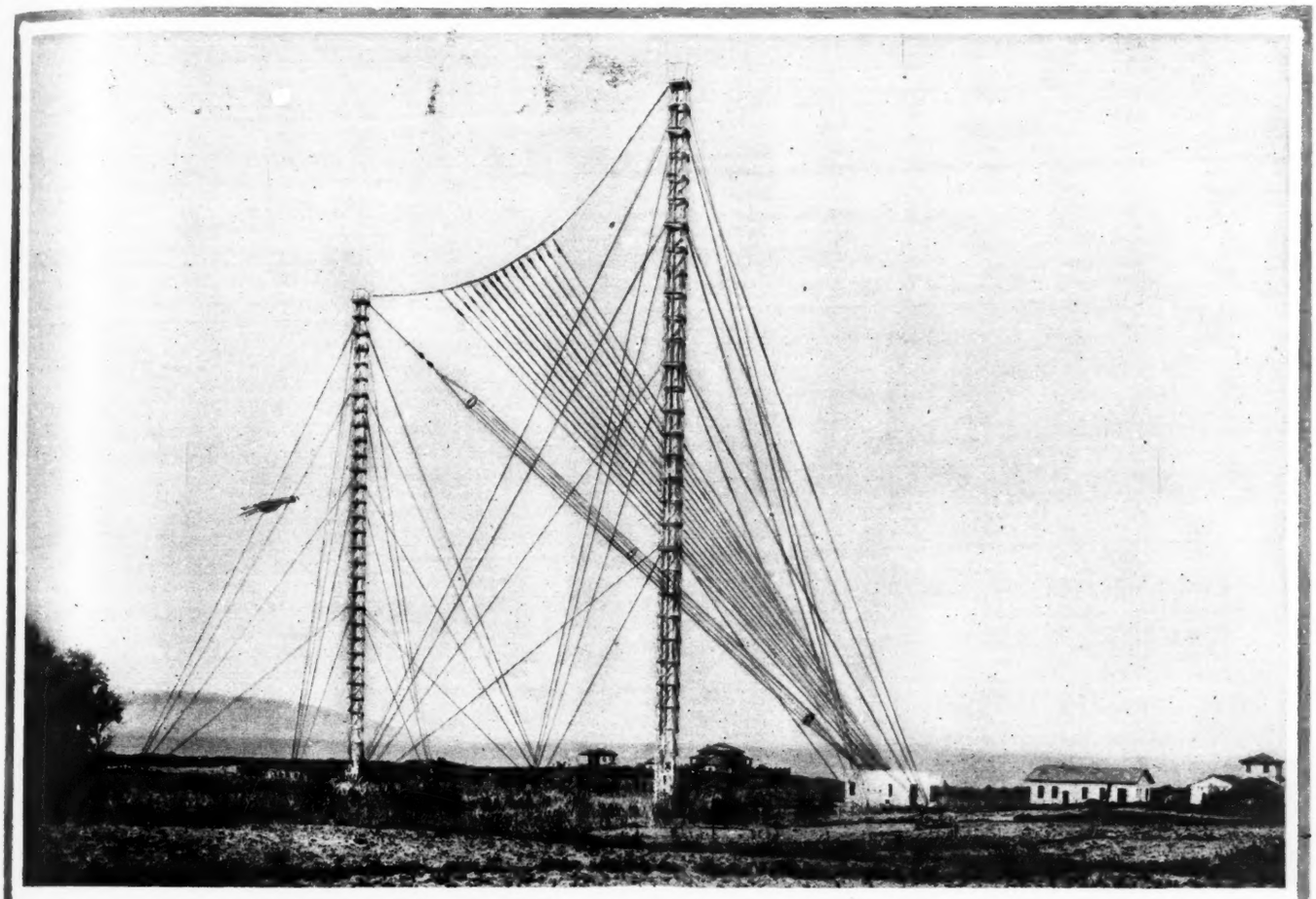
It would be very convenient for the handling of the traffic between ship and shore stations to have all the ships of a certain tonnage equipped with a continuous wave transmitter, which could be used exclusively for the transmission of the messages to the Coast stations, the call being made with a spark set on 600 meters while the messages could be transmitted on a longer wave, varying with the different Coast stations. This ideal solution cannot, unfortunately, be applied at the present time, for if the large British liners can use, for this purpose the 1½-kw. tube set, which the Marconi company installed, most of the ships of various nations do not handle enough traffic to necessitate such an installation, which would prove of great service.

Only the big liners can find advantage in sending their traffic on continuous waves to the long range Coast stations, especially equipped for this kind of work. Such a station, recently installed at Devizes by the British General Post Office, sends on con-

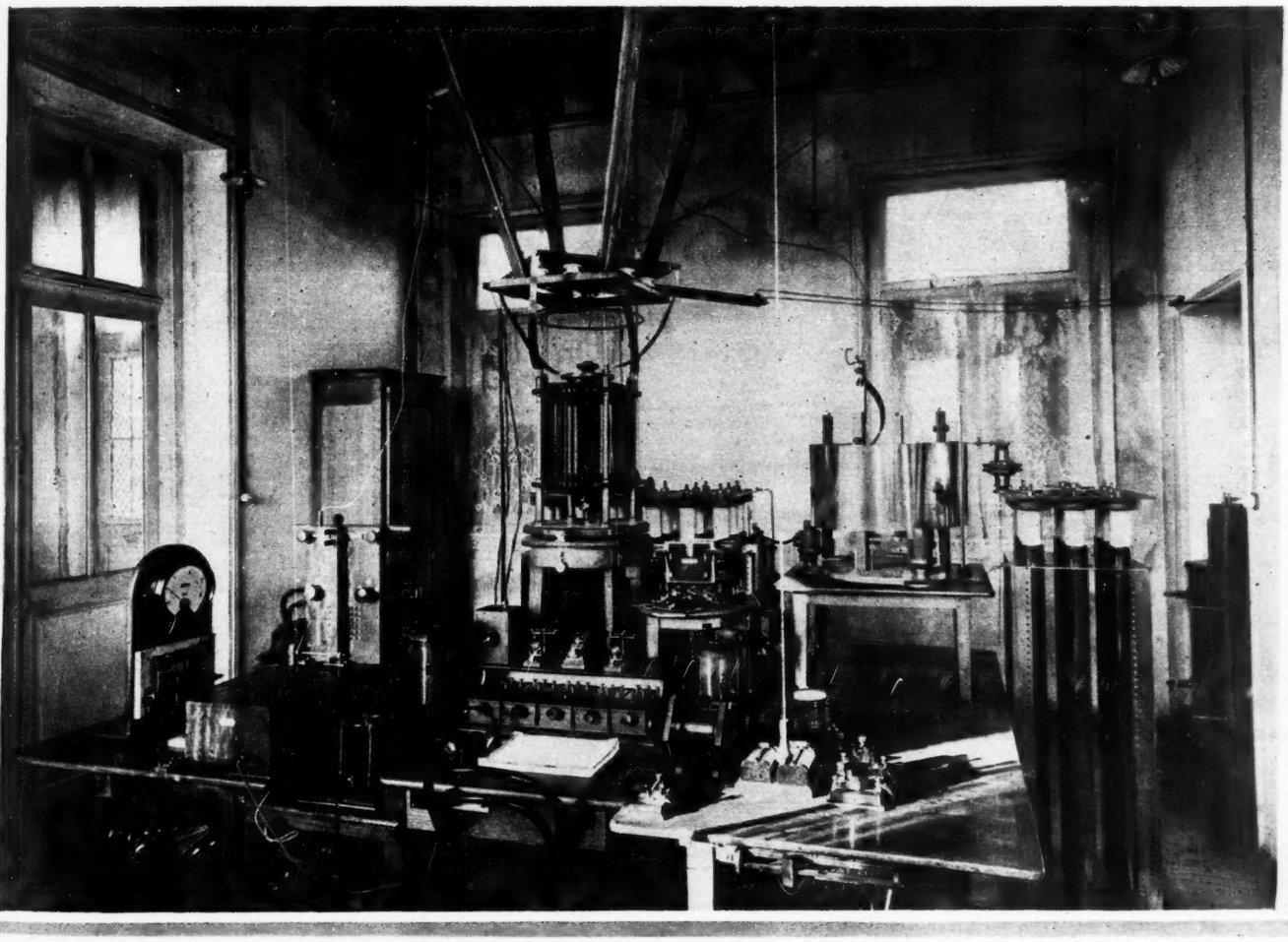
(*Continued on page 673*)

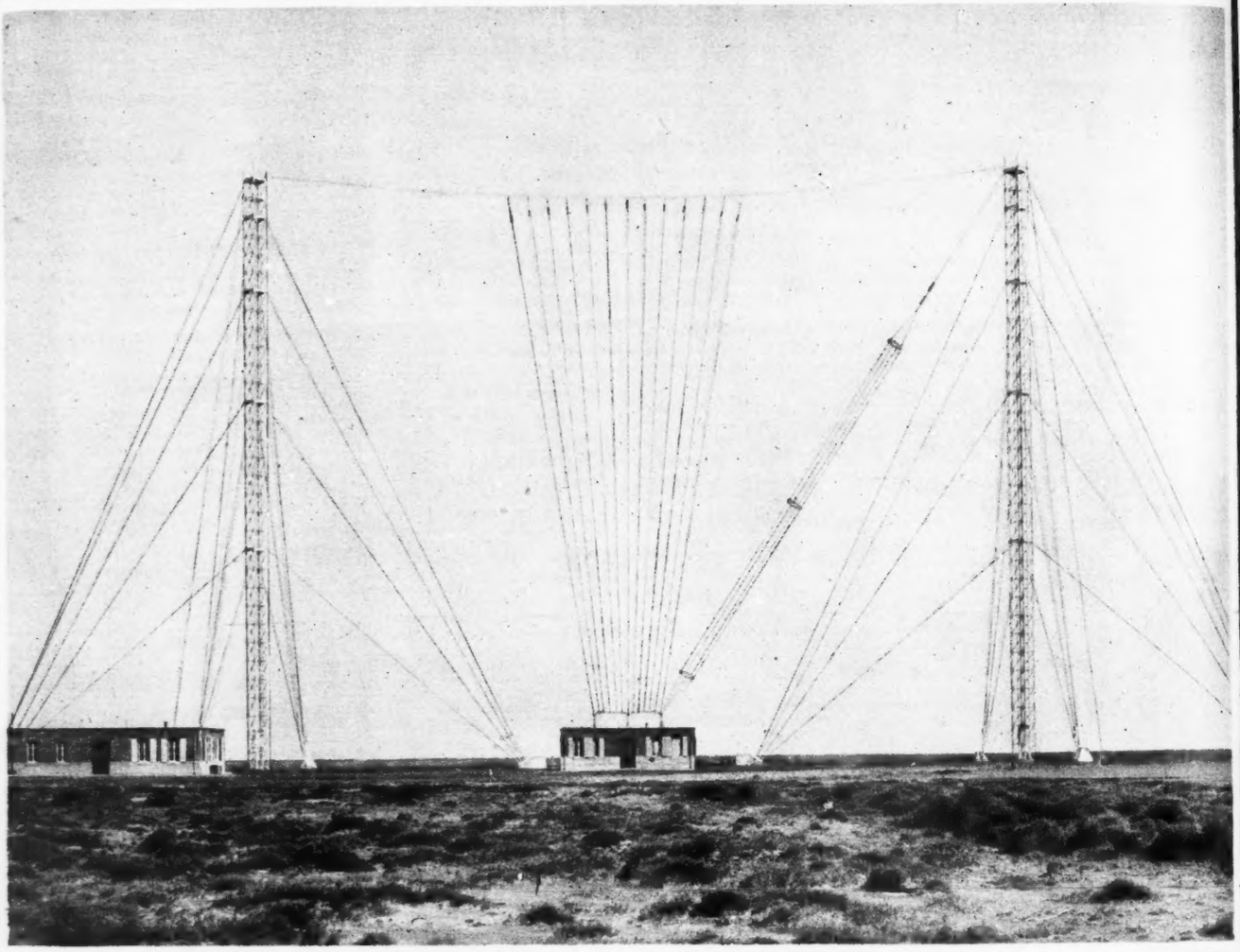
Some of the Interesting Articles Appearing in Practical Electrics for December

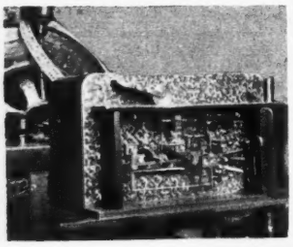
An Old Time Electric Motor.
Ball Lightning, by Professor Stephane Leduc.
The Velocity of Projectiles.
The Haunted Violin, by H. Gernsback.
Lightness in Electrical Machinery.
The First Electromagnet, by T. O'Conor Sloane, Ph.D.
Building an 8-inch Spark Coil, by H. Winfield Secor, Associate Member, American Institute of Electrical Engineers.
Construction of a Small Whimshurst Machine.
An Electric Protector for the House in a Rainstorm.

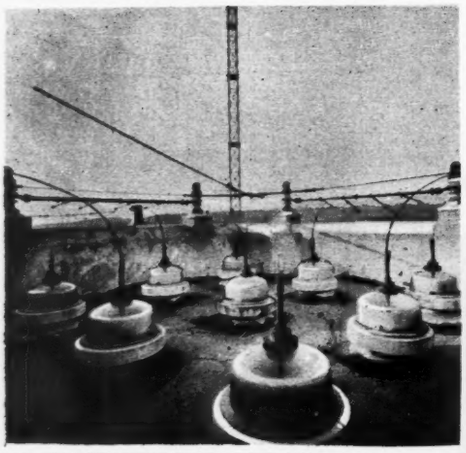


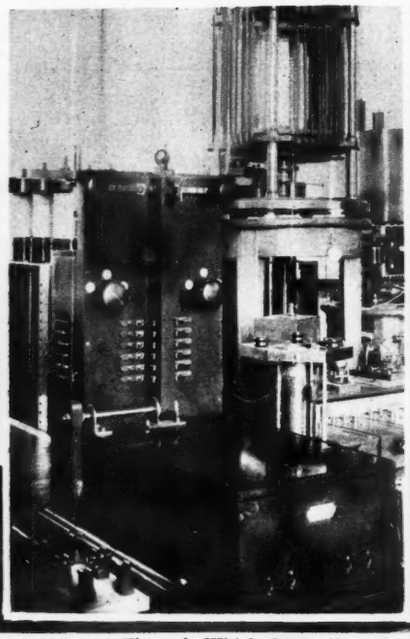
Above is a View of the Fort de l'Eau Station, Erected Near Algiers, North Africa. The Fan Aerial is Used for Transmission and the Cage Type One Fixed to the Left Tower for Reception. This Station is Equipped With Three Sets of Two, Five and Ten K.W., and Handles Much Traffic With Ships in the Mediterranean Sea. Below is Shown the Inside of the Boulogne Station of the Tosi Bellini System for Directional Transmission and Reception. In the Center May be Seen the Special O.T., Having Two Secondaries and a Primary Rotating Inside, as Well as the Four Lead Ins. On the Table Are the Receiving Apparatus and on the Right the H.T. Condensers.

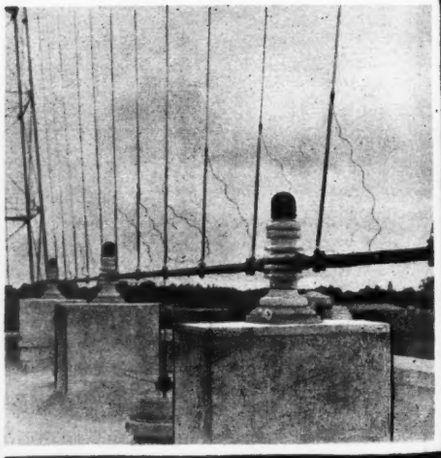








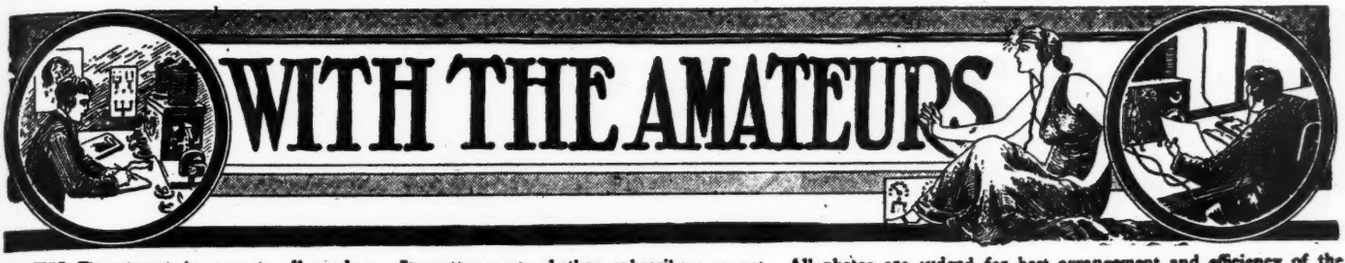




Above, the Large Photograph Shows the Ste. Marie de la Mer Coast Station Erected Near Marseilles, France. The Location of This Station is Ideal, and it Has a Very Long Range Despite the Low Power Used. This Station is Equipped With a 2-K.W., a 5-K.W. and a 10-K.W. Set. Also a 100-Watt C.W. Transmitter.

In the Center of the Page are Shown an Automatic Transmitter and the Special Typewriters Used to Punch the Paper Strips Passing Through it. On the Left is a Detailed View of the Machine, With Cover Removed. These Automatic Transmitters are Especially Used for Sending Press Messages.

In the Lower Left-Hand Corner May be Seen the Insulators Through Which Connections Are Made to the Counterpoises Fixed to the Roof of the Building, While on the Right Are Shown the Lead In Insulators and the Springs Attached to Each Wire of the Fan Aerial, Which Keep Them Constantly Straight. The Lower Center Photograph Represents the Special Change Over Switch of the Directional Station at Boulogne, Closing and Opening All the Circuits in One Operation. Above it May Be Seen the Special O.T. and the Rings and Brushes Through Which the Current Flows to the Primary.



THIS Department is open to all readers. It matters not whether subscribers or not. All photos are judged for best arrangement and efficiency of the apparatus, neatness of connections and general appearance. In order to increase the interest in this department, we make it a rule not to publish photographs of stations unaccompanied by a picture of the owner.

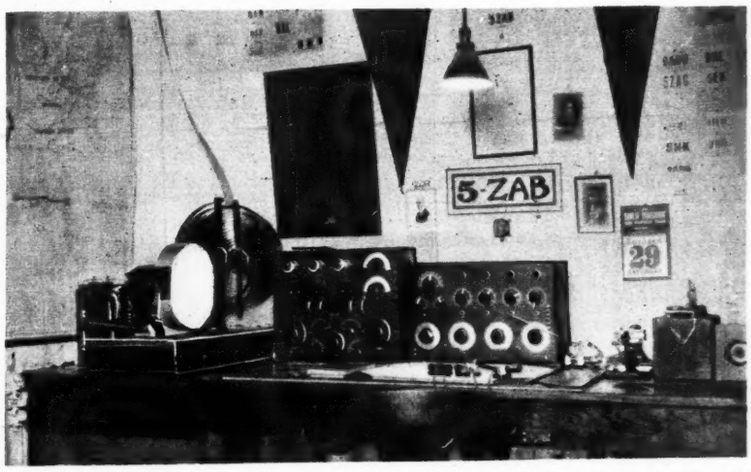
We prefer dark photos to light ones. The prize winning pictures must be on prints not smaller than 5 x 7". We cannot reproduce pictures smaller than 3½ x 3½". All pictures must bear name and address written in ink on the back. A letter of not less than 100 words giving full description of the station, aerial equipment, etc., must accompany the pictures.

PRIZES: One first monthly prize of $5.00 All other pictures published will be paid for at the rate of $2.00.

Francis L. Pullin's Station 5ZAB

At Houma, La.

This Month's Prize Winner



Here is a neat and well designed station with the sending set compactly arranged and the leads short. Good work, O. M., our compliments for it.

I SUBMIT herewith photo of my station 5ZAB, which was taken for RADIO NEWS. The antenna for transmitting is a 10-wire L, 48' long and 70' high, composed of stranded bronze on porcelain insulators with 24" electrose insulators on each end. The ground system is simply four coils of wire buried in the earth, as water is found at 2' all the year 'round.

The transmitter consists of a 1-k.w. Clapp-Eastham 40,000-volt magnetic leakage transformer, high tension plate glass condenser made of ⅜" plate glass and brass foil armatures. There are 52 of these plates covered on both sides with foil and the whole is immersed in oil. The oscillation transformer is made of 1¾" phosphor bronze ribbon, with three turns on the primary and 10 on the secondary. The gap used is type TGAC Grebe synchronous. The drum shown in the photo over the rotor was one made by myself to muffle the noise at night; radiation on 200 meters is 4.8 and 6.0 on 300 meters.

The receiver is a regenerative type for short waves with detector and three step built in. A compound type is used for long waves. The receiving antenna is a five-wire L, 35' long and 45' high.

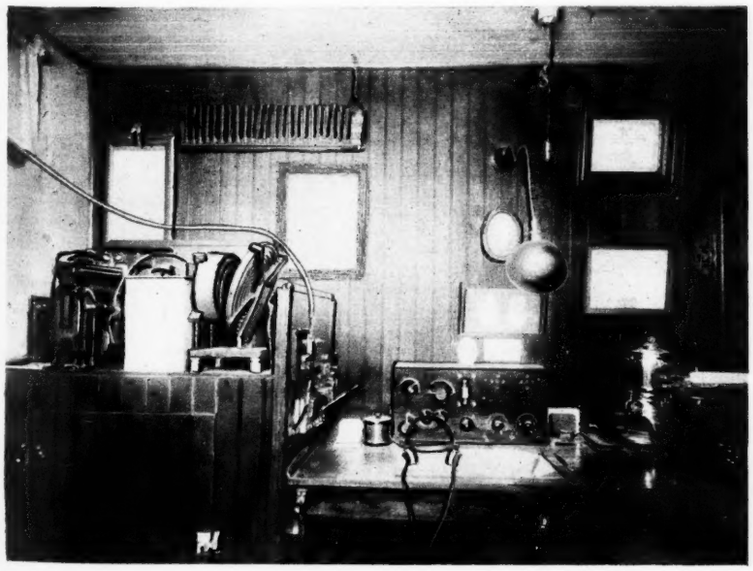
Stations as far north as Polytechnic, Montana, are often heard and constant communication at 1,300 miles is carried on. The entire receiver and transmitter, with the exception of the gap and power transformer, are home made. Neatness is the prime consideration and it is highly efficient.

FRANCIS L. PULLIN.

Gerald Becker's Station 9IY

At Des Moines, Iowa

ENCLOSED find photo of Radio 9IY, Des Moines, Iowa. The transmitter consists of the following: Thordarson 1-k.w. type "T" transformer; glass plate, oil immersed condenser, built in four sections of .01 mfd., connected in series parallel; heavy O. T. with 2½" ribbon in the primary; Torode eight point gap, housed in an oak case, and driven by a quick starting ⅛ h.p. induction motor, spark frequency of 225.



Gerald is a D.X. man who knows the value of a cup of coffee at night, while clearing the traffic; the percolator, which may be seen on the right proves it!

The receiver consists of an improved ultra-audion renegerative receiver, and two-step amplifier mounted in one cabinet. Two "B" storage batteries, as described in a past issue of RADIO NEWS, are used, one giving 50 volts for the detector, and one of 100 volts for the amplifier. Brandes Navy phones complete the receiving equipment. The electric coffee urn, shown in the picture, while not contributing to the set, is placed on the "hospitality" committee, and from its popularity, I would say it succeeds very well.

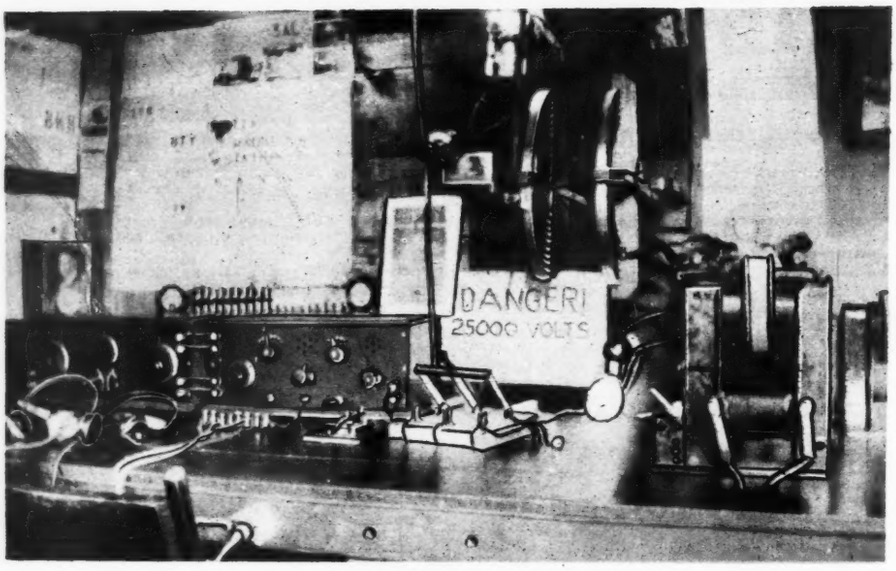
With this set installed in a much poorer and inefficient place, it has been heard in 16 States, including Pennsylvania, Montana, Texas, Georgia, and Colorado.

The aerial consists of five wires, flat top, 50' high, and 64' long, a lead-in of five wires being taken from center and brought together 15' from the ground. Ground is a buried cable under the aerial.

GERALD BECKER,
East 30th and Dean Streets,
Des Moines, Iowa

J. Planty's Station 8ANW

At Niles, Ohio



Thanks to His Efficient Station, Planty Need Not Buy Wall Paper for the Radio Room in His House; He Got So Many Cards From All Districts That He Had Only to Glue Them Together to Make a Nice Decoration!

STATION 8ANW belongs to J. Planty, of 710 Warren Avenue, Niles, Ohio. My receiving set consists of a regenerative receiver, a detector and two-step amplifier. I use an old style audiotron as a detector, a Moorehead for the first step and a Radiotron for the second, with Stromberg, Carlson and Brandes phones. My sending apparatus consists of a 1-k.w. Thordarson transformer, oil condenser, a Benwood spark gap, a Penn "C" pancake type of oscillation transformer and a five-wire aerial. These wires are spaced 2 ft. 6 in. apart and are 70 ft. long and 30 and 40 ft. high, being of the inverted L type. A counterpoise is used for sending, and is composed of 16 wires 60 ft. long, which are spaced about 4 ft. apart; this is erected about 7 ft. from the ground. A big 1-k.w. switch on the table controls everything. When the switch is thrown up, a red light gives warning, the rotary gap is started and the juice is connected to the key and the transformer, throwing out the receiving set. When the switch is thrown down, it disconnects the sending set, starts the receiving set and lights a white lamp. A word from amateurs hearing 8ANW will be appreciated.

Up to the present time, I have not experimented much with C.W. transmission, for I realize that it would cost me a lot of money and time to produce a C.W. transmitter, which would be as efficient as my spark set. This is the great drawback of the system of transmission, for if one considers the prices of the tubes, motor generator and other parts necessary for the construction of an efficient "lamp set," one certainly does think it over twice before deciding to send the stone crusher to the junk pile. For me, I have decided to keep it on the job.

Edmund S. Smith's Station 8BDI

At La Salle, N. Y.

THE accompanying photo is a fairly good view of my station, call 8BDI. Practically all of the apparatus is of my own manufacture, and a large part of the instruments are of my own design. Various articles in past issues of this magazine also influenced the design and construction of the apparatus.

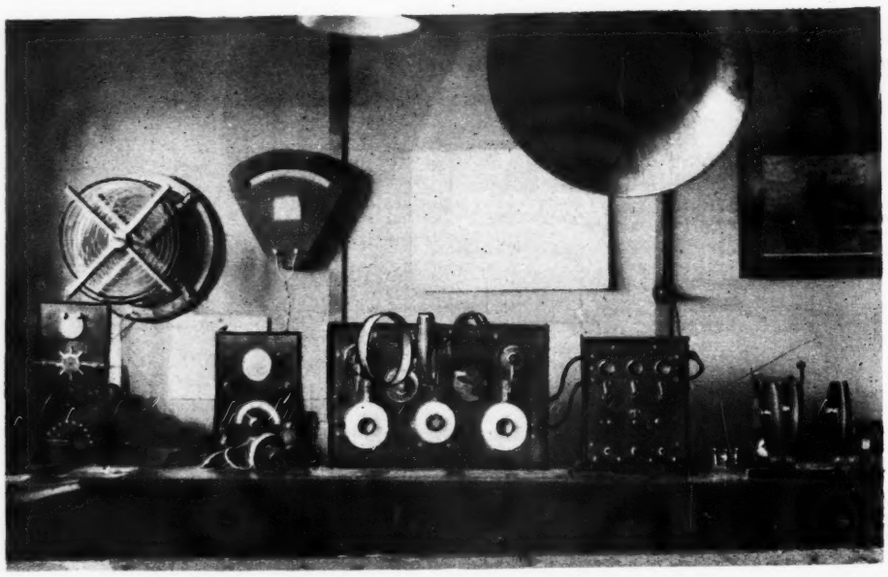
Two aerials are used. One four-wire 70' antenna is used for transmission and short wave reception, and another single wire 540' aerial is used for receiving longer waves. Both are elevated about 40' at one end and 35' at the opposite ends. I started in the game before the war with an old Marconi receiver, having a single-slide tuner, carborundum detector, etc., and passed through the progressive stages of radio until my present set was designed.

At the extreme left of the picture is an old Edison phonograph (not entirely visible in photo) which was purchased for the purpose of recording important messages, but due to inability to procure a suitable recorder, the idea had to be abandoned. The next instrument is the spark transmitting panel, above which is the O. T. A ½-k.w. transformer coil furnishes the high potential. I intended to install a better transmitter, but due to the increased popularity of radio telephony, I turned my energies in this direction. The radiophone is the next piece of apparatus. Two five-watt tubes are used in parallel, and their plate voltage is furnished by Edison and lead-plate storage batteries. As this transmitter has just recently been completed, only a short distance has been covered so far (six miles with 108 volts on the plate); 260 volts from batteries is now available for this purpose. Rectified A.C. is not suitable for C.W. work in this vicinity because the commercial frequency is 25 cycles, which causes a very loud transformer hum. Above the radiophone is a two-ampere hot-wire ammeter, the construction of which was described in the first issue of RADIO NEWS.

The next instrument is the tuner cabinet of the receiving set. The large coils in the honeycomb coil mounting are Groves coils, which are quite popular in this section of the country, and mine are used for waves between 150 and 600 meters. These six coils have 10, 20, 25, 30, 35, and 50 turns of wire on them respectively, and their inductances are so nearly the same that no switches are needed to tune to the different wave-lengths, thereby doing away with dead-end effects. In fact, multi-point switchs with their detrimental effects, were done away with entirely in the receiver. Duo-lateral coils are used for waves above 600 meters.

At the time the picture was taken, a novel feature of the set was a fiber panel beneath the top of the tuner cabinet, to which the connections of all the instruments comprising the detector circuit were brought. By merely removing the top, the hook-up could be quickly changed to almost any combination, and this feature enabled me to try out nearly every circuit that came to my notice. The best of those for short waves was selected and permanently connected, the fiber panel having been removed, so that very short leads and more soldered connections would prevail. This last step resulted in a marked increase in selectivity and audibility of received signals. On each side of the coil mounting is a Connecticut variable with an extension arm to prevent ca-

(*Continued on page 664*)



Although He Has a Midget Sending Set, This Fellow Has Some Aerial Ammeter! Nevertheless He is a Clever One and Built it Himself, as Well as His Other Apparatus. Our Compliments, Ed

NORTHERN ORANGE COUNTY RADIO ASSOCIATION

At the meeting of October 28, 1921, the Northern Orange County Radio Association passed the following resolution. "Resolved, that the members of this organization shall not transmit or relay messages which may be construed as commercial or as encroaching upon the commercial telegraph or radio field."

We think that with the co-operation of every operator on this resolution that it will be of great benefit to Amateur radio.

R. Wayne Goodale, Sec'y.

THE HUDSON RADIO CLUB

"The Hudson Radio Club", one of the largest and most successful radio study groups in Manhattan, now established in the new home at the Columbia Preparatory School, started with a small group of eight charter members organized in March, 1920, and has grown to the large number of forty members at the present time.

The members of the club consist of amateurs, graduate engineers, university under-graduates and professional mem who are interested in radio work either from a commercial, scientific or experimental standpoint, and the majority of the members have their own radio sets.

Dr. Clawson, principal of the "Columbia Preparatory School," 301 West 88th Street, New York, made it possible for the club to have a permanent home by extending the use of one of his classrooms every Saturday evening and permitting the club to erect the aerial on the roof of one of the school buildings and construct the operating room in another of the small classrooms. Club members are permitted to use the operating room every afternoon and evening and the club log book is kept by the member in charge of the station that particular day.

The set, installed at present, is a short wave regenerative with two steps of amplification all of this apparatus being assembled by the members of the club.

The entertainment committee of the club arranges with a prominet radio authority to be the speaker of the evening at every Saturday Session and four social evenings at prominent hotels are held during the year. The lectures are very interesting, entertaining and instructive to the amateur who acquires practical knowledge which he can apply in the construction and successful operation of his own set, and in the correction of troubles which arise from time to time in his own set. For this reason the club is one of the most interesting organizations in the metropolis.

The officers of the club are: Fisk Bingham, president; Gouine Kilbourne, vice-president; Herbert Weil, secretary; and Robert Morris, treasurer.

POULTNEY EXECUTIVE RADIO COUNCIL

The Poultney Executive Radio Council was organized on Nov. 1, 1921, at the station of Mr. Frank Fassett, Radio 1-BOX. Eight charter members were present. A constitution was adopted and the following officers elected: President, Frank Fassett; vice-president, Walter Hitt; secretary, George Town; treasurer, Emerson Pray; chief radio instructor, Victor Borst, Radio 2-BIA. The purpose of the organization is "To promote the art of Radio Communication in Poultney and vicinity and to eleminte Q.R.M." The president spoke briefly on the subject of "The Radio Communication Laws." Code practice was held and satisfactory progress was made. Hereafter meetings will be held on the first and third Mondays of each month. Membership is not restricted to Poultney residents and any radio enthusiast in the vicinity desiring membership will please communicate with the secretary.

NEW MEXICO STATE COLLEGE RADIO CLUB

The New Mexico A. & M. Radio Club has been reorganized this year with the purpose of getting down to business and setting a new record in amateur radio. The club is operating in conjunction with the College experimental station. Meetings are held every other Wednesday evening. After adjournment, most of the members remain for code practice. Also, every Saturday evening, Dean Goddard conducts a class on the theory and practice of radio. The club is fortunate in having Mr. R. W. Goddard, Dean of Engineering, as an active member. The fact that he has a thorough knowledge of radio and practices it on his own station, 5ZJ, makes him a valuable asset to the club.

A new fan type antenna is under construction. It has a height of 140 feet and a span of 160 feet. The transmitter will consist of two 250 watt tubes and accessories. This transmitter is expected to have a range of at least 3000 miles and will hold first rank among the DX stations. Most of the parts are enroute, though some have begun to arrive.

All communications should be addressed to Morris White, secretary, State College, New Mexico.

BAR HARBOR, ME., RADIO CLUB

The first meeting of the Bar Harbor Radio Club was held October 22nd, at the home of Hiram Heinie Meyers. The following officers were elected: President, H. Heinie Meyers; vice-president, D. Mecca; secretary, W. E. Fitzswanson; treasurer, S. T. Smith; chief operators, M. Rex and H. S. Routzahn; mascot, Stevie Z. Edwards.

This organization, in spite of its recent origin, has done wonders and expects to do a great deal in the future towards the radio development of this part of the state of Maine. The mascot, Stevie Z. Edwards, in spite of his ignorance, is willing to learn and should prove a valuable addition to the world's supply of great radio engineers when he becomes old enough. The present membership is fifteen and the number is expected to increase weekly.

The principal aim of the club is to teach the hams; placing practice sets at their disposal, and teaching the fundamentals of radio in all its branches. Code receiving and the development of a good fist is emphasized.

Meetings are held daily at number 15 Otter Cliff Road, where code practice is held and lectures are given for the benefit of those who can possibly attend. A semi-compulsory meeting is held every Saturday night when all members are expected to be present.

Our first meeting was a howling success. Several prominent Bar Harbor and Otter Creek business men were present and gave lectures on "Efficiency" and "The Keynote of Club Success." President H. Heinie Meyers read an interesting manuscript dealing with the testing and tuning of simple receiving sets. This was followed by a lecture from Chief Operator Routzahn, on "Work to be Accomplished." Stevie Z. Edwards then gave an interesting and very amusing talk on "Ambition." A number of good ideas and resolutions were set forth for consideration and several have promise of adoption at our next weekly meeting. An annual convention to be held at Bar Habor is under consideration; the success of the convention hinges upon the success of the club which is coming along fine.

Communications from other clubs and organizations are cordially invited. Address the President, H. Heinie Meyers, Bar Harbor, Maine. All amateurs within "shooting distance" are invited to call and make themselves at home.

NORTHWESTERN RADIO ASSOCIATION

The fall dinner of the NW Radio Association was held Nov. 7, 1921.

At the East Side Business Men's Hall in Portland, Oregon, eighty-four hungry hams with their friends feasted to their heart's content, made merry over after-dinner speeches, danced until late in the night and on the whole enjoyed a regular honest to goodness "hamfest".

Loren C. Maybee of Pasco, Wash., gave us a first hand account of his experiences at the Chicago convention. How we wished we could have been there too! To say that everyone enthusiastically received his account is putting it mildly, and who wouldn't thrill in the anticipation of our A. R. R. L. National Convention in conjunction with the World's Fair at Portland in 1925? The spirit manifested by all present was more than convincing proof that this convention will be put over with a vigor and vim that will warm the heart of any radio man who takes a pride in the great big A. R. R. L. spirit of citizen radio. C. A. Lockwood, of Salem, Ore., gave us an insight into the life of a regular navy operator in relating his experiences aboard the U.S.S. George Washington. Of course we were glad to see Alfred L. Adams, of Salem, Ore., better known as 7IN for we wanted to ask him what he had done recently to make his spark pound in the way it does. And did we enjoy the ensuing hamfest? I'll tell the world we did.

Among local amateurs who were called on to say a word or two we find, George Cameron, (7DP), president of the N. R. A.; Jack Tait, (7JW), treasurer; John Hertz, first vice-presdent; George Criteser, (7ZT), second vice-president and publicity agent; Willard B. Hawley, owner of the pride of the locality, a 100-watt C.W. set; Dr. Labby; Royal Mumford, (7ZJ); and others. Walter Russ, (7ED), our secretary, acted as an able toastmaster.

After the tables were cleared away everyone enjoyed a general "hamfest" and get-to-gether. A large number of the fair sex were present and those who cared to, enjoyed dancing to the best music of the Remic Song Shop amplified by Mr. Hawley's magnovox. In the prize "DX Special" waltz, Mr. Maybee (7GE), with Miss Coryell, of Portland, waltzed away with first honors. Mr. White dancing with Miss White received the second prize. Mr. Berggen and Miss Bradley won third prize.

The best issue of our local paper, "Hamograms," that we have ever seen was handed to us as we left, and I want to say that we sure did hate to break up such a gathering even if it was to go home and put in a couple hours of early morning DX work.

STATE COLLEGE RADIO CLUB

The regular bi-monthly meetings of the Radio Club took place on the ninth and twenty-third. The first meeting was taken up principally with a report of the committee on the revision of the Constitution. After much discussion and some revision of the outline submitted, the Constitution was adopted. The second meeting received a report from Dean Goddard on his recent trip to New Orleans with a description of the various amateur and commercial radio plants visited. Arrangements for various tests with Texas and Louisiana stations were made. Dean Goddard made especial mention of the warm hospitality shown and the fine boosting spirit expressed by every amateur visited.

Every Saturday most of the members have turned out to help on the erection of the new plant. One of the 140 foot towers is in place and the other is about ready to be raised into the air. The trench for the "Round Round Ground" is about half completed. This ground is a circle of heavy hog wire fencing sixty feet in diameter and buried from four to five feet in the ground. Radial wires run out to it from the ground connection in the Radio House. The antenna will be a fan of 140 foot height and 170 foot spread. This will be inclined slightly between the two 140-foot masts on the Engineering Building and two 40-foot masts by the Radio House.

During the reconstruction 5ZJ has been transmitting for 5XD. Regular schedules have been maintained with 5ZA to the east and 5ZAD to the south. Other stations have been worked as occasion required. Following the football game with the New Mexico Military Institute a two thousand word report of the game was broadcasted. This was copied by stations at Roswell, N. M.; Alamogordo, N. M.; Albuquerque, N. M.; El Paso, Texas, and Tucson, Ariz. Much credit is due Mr. Louis Falconi, 5ZA, of Roswell in getting this and delivering it to the local newspapers as well as posting it in several public places. This report was the only one received in the Institute's home town until two days later when the mail arrived.

PHILADELPHIA AMATEUR RADIO ASSOCIATION

The Philadelphia Amateur Radio Association held its last regular meeting on Monday, December 5, 1921, in the Widner Memorial Library, 1200 North Broad Street. As it was the beginning of a new year the club held the elections for officers which resulted as follows: Dr. G. M. Christine, president; Mr. John Delp, Jr., vice-president; Mr. Bradley Martin, secretary and treasurer; and Mr. Joseph Forsyth, corresponding secretary.

A paper written by Mr. E. C. Powell on "Data on Radio Frequency Coils for Reception" was read. Also a paper was read on "A Long and Short Wave Receiver" by Mr. Stanley Bryce. A short time was devoted to questions and answers. These meetings are held on the first and third Mondays of each month and every amateur living in or around Philadelphia is urged to attend. The membership is large and the attendance is very good.

NEWPORT RADIO CLUB

The Newport Radio Club has resumed operations at the Newport Y. M. C. A. on Mary Street. Our call is 1CCD. We wish that all amateurs would notify us when they hear us as we are installing a phone and CW. The following officers are in charge: Mr. W. C. Sweet (1BXQ), president; Chas. Easterbrooks, secretary; and Whitehill Thompson, treasurer. The meetings are to be held every Thursday night at 7:00 P.M. The club would be pleased to communicate with other clubs. Do not hesitate to write to us. Our receiving outfit is a Clapp-Eastham regenerative mounted by the club members. We also have a weekly paper put out by the members of the club. Now other clubs, do not forget to write.

THE PALISADES RADIO CLUB

On November 12, 1921, several hams from Fort Lee, N. J. and vicinity met and formed a radio club. The name "Palisades Radio Club" was unanimously adopted and officers were elected as follows: President, John E. Kerhnast; vice-presi-

(*Continued on page* 618)

Who Can Use This Man?

By "The Wanderer"

I HAVE just finished an hour's perusal of various radio publications for some months back. Did you ever note the numerous ads of the radio schools, that fairly radiate "Opportunity" for one versed in the radio art? And how about the editorials, and articles, all listing the marvelous future awaiting the man who makes a serious, scientific study of the most fascinating trade? I was surprised at the frequency of such ads, articles and editorials, and more surprised to find that I was a backer of such claims until now. Now, I'm afraid I am becoming a "Doubting Thomas." Let me explain, and don't mind the egotism; I must talk of myself to prove my claims.

Until a week ago, I was steadily employed; 'tis well to be perfectly frank, so I'll say, I was a Chief Radioman in Uncle Sam's Navy. Last week I obtained my discharge, and decided to grasp one of the numerous "Opportunities" that were floating about me. But what do I find? I'm still looking for opportunity, and I haven't been slow this last week either. Every radio operating company or manufacturer whom I have approached, has had the same answer, in effect, "Really not a thing open." Now if there is "Opportunity" for he graduates of a correspondence or residence course in radio, how come an old-timer has to sit out in the storm?

What does the school graduate face the radio world with? A diploma and a headful of rather hazy ideas in regard to just what he is about to enter into. Mind, I have no intention to belittle the efforts of the radio schools; they offer some excellent courses of instruction; but it's the same in every game: a green man stepping out into the trade, is next to worthless until he gets "onto the ropes."

Now, you say, what have *I* with which to face the radio world? Well, I'll blow my own horn. I've read, slept and eaten radio for thirteen years. I graduated from the carbon and needle into the electrolytic, then the crystal detector stage, and then Fleming's Christmas tree light; DeForest's old "Hudson filament" audion and so on. I'm still keeping pace with the new stuff, and it is some task. I haven't broken away from the game once in the thirteen years, and I never will, if I have to peg shoes with one hand, and turn the rheostat up with the other. I've operated, built, designed and set up all manner of radio installations. I *DO* know my radio, and refuse to be stumped. I've been on pretty near all of the seven seas, and coastal stations in many lands. I know conditions in various climes. The Department of Commerce thought my knowledge sufficient to give me an Extra First Commercial License. *BUT*—I can't land a berth as operator on an inland TUGBOAT even! I've tried; and my reputation is A-1, where I'm known. Now, what is the trouble? Where are all the "Opportunities" that are so widely proclaimed? Manufacturers, where do you get your radio engineers, designers, assemblers, draftsmen, etc.? I remember hardly an ad for radio help wanted, in magazine, newspaper or other source? How does the manufacturer and his employees first get together? Don't tell me that I'm not in touch with the commercial end by reason of being a navy man. I'm not; only put in my war time enlistment, plus a year to tide over hard times (still seem to be hard). I was a Marconi and Kilbourne Clarke man before the war; plus being "on my own" in the radio engineering game for awhile. I know the commercial side as well as navy, and as for amateur, well, I'm sufficiently in touch with that situation through maintaining a "ham" station wherever enough ground grew to plant a pole, so that I've built up the radio retail game for several dealers, to where they re leaders in their territory. Oh yes, "I can PROVE all these things."

Enough of this, though: I didn't know it was such a pleasant sensation to "toot your own whistle" before the world. I'll get warmed up to it and never stop if not now. The point is though, who's going to dispel all my doubts as to radio opportunities? Where is the manufacturer who is going to write me and say, "Come along, son, I can use you"?

Now's your chance, you big advertisers. Prove that there IS opportunity in the game. Furthermore, as an added inducement, be informed, that I am willing to go ANYWHERE in the world, civilized or not, and if the job pays at least one hundred twenty-five a month, I'm your meat! Don't gasp! I'll ask for more, just as soon as I have the chance to prove to you that you've not been stung. I know the editor isn't running an employment bureau, but I'm just about daring him to publish this "dope sheet," to prove that there IS room in the game for an old-timer who "eats radio alive." If he won't pay me for this stuff, I'll pay him. Fair enough, eh?

JUST as we go to press, we receive the accompanying article. We know the man, but for obvious reasons do not give his name. This man is at the height of his profession, and has written numerous technical articles for RADIO NEWS for some time past.

What we would like to know is, is this man right or wrong? Are there opportunities in the Radio game, or are there not?

We are reproducing the letter for two reasons. First, to get employment for a very worthy member of a fraternity, and second to prove to the same fraternity that there really are opportunities.

If you, Mr. Manufacturer, or Other Interested Party in Radio have a position for this man, kindly write the Editor at once. We will be glad to publish the results in the next issue.

Address all letters to "Wanderer," care of RADIO NEWS.

—Editor.

Correspondence from Readers

MAKE IT SIMPLE.

Editor RADIO NEWS:

I have been reading some articles in the RADIO NEWS and am glad to find that at least one writer realizes what a vast amount of territory in the United States is undeveloped as regards radio.

Mr. Armstrong Perry is absolutely right when he states that small towns contain potential "radio bugs." Most writers, like G. Y. Allen, for example, seem to treat the tuning coil and crystal detector stage as ancient history and regard all amateurs as advanced into the V. T. and regenerative class. They fail to realize that we must all make our start and that signals brought in with a tuning coil and crystal detector have as much charm for the beginner as signals brought in later on better sets.

It is on these beginners that the future development of radio depends. Some system such as suggested by Mr. Armstrong Perry should be worked out by which these budding amateurs can be steered straight until they are developed into full-fledged "bugs." The beginner who sees nothing in Radio magazines but instruments he knows nothing of is inclined to give up in despair because he feels that he can never catch up.

In closing I will say that RADIO NEWS is surely a big help to beginners and that "Junior Radio Course" and "Junior Constructor" are steps in the right direction.

R. H. STRONG.

Bicknell, Calif.

AMATEUR RADIO IN CHINA.

Editor RADIO NEWS:

I am enclosing an extract from a letter which I received the other day from a radio friend in Shanghai, China. He gives a very interesting account of conditions that obtain and work that is being done over there.

D. W. EXNER, 2 BNF.

—One day I got the idea of setting up a wireless. That was in the fall of 1919, just after I had come back from the States. Well, I set up an aerial, hardly knowing at the time what the purpose of the insulators was. But anyway I followed the Scout Manual and managed to get away with it. In a few days I was getting local stations and immediately became head over heels in enthusiasm. I guess a good many fellows have started off worse, but anyway that first set of mine served the purpose. I had a slide tuner and a crystal. Now Shanghai is an awful place for QRM. Everybody is on 600 and it's fierce. There are a few amateurs and even they can use any wave they like. It is just about radio heaven until the darned Jap warship down the harbor opens up on about 10 K.W. and sends for hours at a stretch. Honestly those sets must have some gaps. Summer before last I heard one of those ships send a dash seven minutes long. This is straight goods, but why he did it is more than I know, and at the end of the seven his note wasn't breaking at all. But to get back to the subject. I kept fooling around with that set and gradually learning the code. I had an awful time studying Latin that year, with that pesky thing in the corner wailing out the frog-like

(Continued on page 630)

Underground and Submarine Antennae

(No. 1,388,836, issued to Earl C. Hanson.)

This invention relates to radio communication and more specifically to an underground and submarine

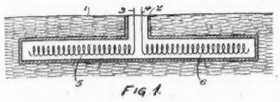


Fig. 1.

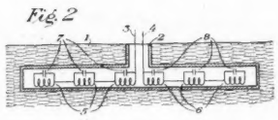


Fig. 2

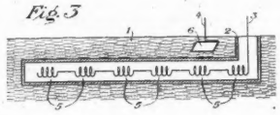


Fig. 3

antenna for use in the reception of radio signals. Fig. 1 of the diagram is a sectional view, showing one arrangement of an underground antenna within a conduit in which the antennae are formed in spirals. Fig. 2 shows a modified arrangement of the antenna within the conduit in which the series of lumped inductances shunted by condensers are inserted at intervals throuought the length of the conductors. In Fig. 3 is shown the conduit enclosing an antenna having only lump inductances inserted at intervals throughout its length.

The underground or submarine antennae are constructed in the form of spirals to eliminate the response of such an antenna system to strays, as encountered in radio telegraphy and telephony. The antenna shown in Fig. 1 will respond favorably to sustain wave transmitting systems. This antenna, when once set in oscillations, will continue to oscillate in its own periodicity. In Fig. 2, the inductances shunted by condensers, from tuned oscillatory circuits throughout the length of the antenna, which makes it possible for sustained oscillations to pass, but which act as retarding means to strays. Fig. 3 shows a series of lumped inductances in an underground or submarine antenna, which can be used with a similar underground system, or an earth connection, as shown at 6.

Thermionic Valve

(No. 1,391,671, issued to Horace St. John de Aula Donisthorpe.)

This invention relates to an improved Thermionic valve for use in wireless telegraphy and telephony. According to this invention, illustrated in Figs. 1 and 2, hollow

Fig. 1.

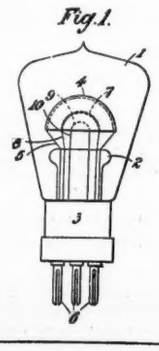


Fig. 2.

hemispherical plate and grid electrodes, or surfaces are employed in combination with a straight or loop filament, source of the cathode rays. In the drawing, 1 designates a vacuum vessel containing a glass pedestal; 2, mounted in a holder 3, in the usual manner. Within the vessel is arranged a hollow hemispherical plate electrode, or surface 4, supported by one or more wires 5, sealed into the pedestal and connected electrically to the plugs 6. Within the plate is arranged a similarly shaped electrode 7, supported by one or more wires. Within or adjacent to the grid, a loop filament is disposed as shown. The advantages of the arrangements above described are that the cathode stream is more uniform when distributed than when the ordinary type of electrode is employed and consequently disintegration is more uniformly distributed, thereby increasing the life of the valve; also, the arrangement serves to damp down or eliminate microphonic disturbances or noises.

Multiple Antenna for Electrical Wave Transmission

(No. 1,388,431, issued to Michael I. Pupin and Edwin H. Armstrong.)

This invention relates to the screening of a high resistance wire-

Fig. 1.

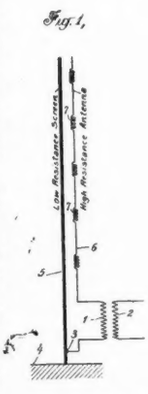
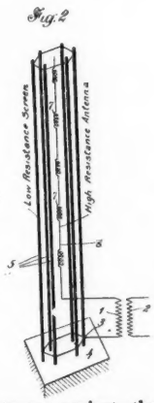


Fig. 2



less receiving antenna against the disturbing effects of electrical impulses of short duration by connecting it to another antenna of low resistance and low inductance. Fig. 1 is a representation of the construction which embodies this invention and Fig. 2 shows a modification. 4, 3 and 5 constitute the linear low resistance vertical antenna in which there is no inductace except the uniformly distributed inductance naturally associated with it. The high resistance antenna, 3, 1 and 6, is connected at 3 to the low resistance one. This high resistance antenna is the receiving antenna and it is supposed to be tuned to some frequency which is within the interval of frequencies now employed in wireless transmission. On this account, it carries large amounts of lumped inductance as indicated at 7. This large inductance load in addition to the high resistance makes its coupling to the low resistance antenna very loose in spite of the fact that the linear parts of the two antennae are as closely coupled to each other as is practicable. When an electrical pulse of short duration strikes the two antennae, the low resistance one will absorb the electromagnetic energy conveyed by the pulse. The sudden rise of the magnetic field established around it by the action of the pulse, will prevent the pulse from communicating any appreciable amount of energy to the high resistance antenna. Fig. 2 shows an arrangement in which the high resistance antenna is enclosed within a sort of cage, or screen, formed by several low resistance antennae. This device is claimed to be highly efficient for the protection against statics.

Wireless Transmitting System

(No. 1,391,855, issued to Henry K. Sandell.)

The present invention relates to systems for the transmission of wireless signal, and more particularly to sending means whereby signals are transmitted by the use of

Fig. 1

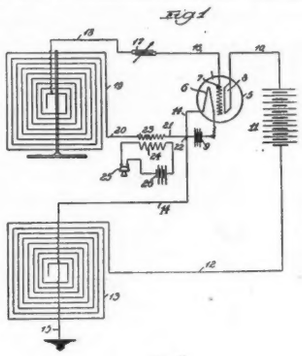
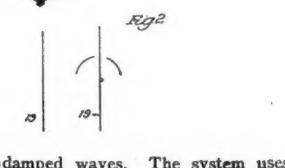


Fig. 2



undamped waves. The system uses two loops, or frame aerials, one of which can rotate around its axis and is connected to the ground. In operaton, on closing the output circuit, the reaction produced upon the loop 19, results in the production of oscillating currents in the output circuits, the two loops acting as a coupling for the production of this effect.

Radio Telegraphic and Telephonic Apparatus

(No. 1,388,936, issued to Horace St. John de Aula Donisthorpe.)

This invention consists of a portable wireless receiving set comprising inductances, a detector, telephonic terminals and electrical connections made up in book form, so that the wave-length is varied by opening or closing the book. A further feature of this invention resides in the combination with the book receiving set, of a telephone plug and telephones. Means are

Fig. 1.

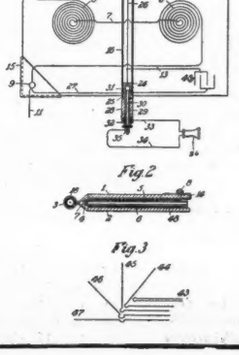


Fig. 2

Fig. 3

provided for maintaining any determined wave-length, or angular relationship of the hinged parts. Fig. 1 is a plan, or open book view, showing the diagram of connections. Fig. 2 is a section through the closed book, showing the detail of construction and the position of the detector 16, mounted in the binding. Fig. 3 illustrates the method of varying the wave-length by opening or closing the book, which varies the mutual induction between the two pan-cake coils.

High Frequency Electrical Oscillation Apparatus

(No. 1,389,255, issued to Leslie R. McDonald.)

This invention relates to a high frequency circuit in which the inductance and capacity are combined in one element. The oscillation transformer, which is composed of wide condensing ribbon, has its turns insulated by a dielectric capable of standing high voltages. The two ribbons composing the primary of the oscillation transformer, act as armatures in the condenser thus formed, providing inductive and capacity coupling between the primary and secondary circuits of the combination oscillation transformer-condenser. Figs. 1 and 2 show the connection of this apparatus into high tension circuits, provided with a spark gap 4. Fig. 3 shows the method of construction, and the relative surface of the ribbon composing the oscillation transformer. Fig. 4 is a plan view of one type of electrostatic means for coupling two oscillating crcuits together. Fig. 5 is a diagramatic plan view of the electrostatic element shown

Fig. 1.

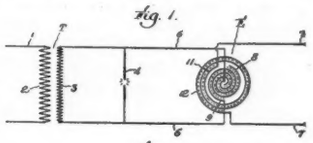


Fig. 2.

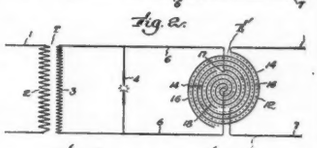
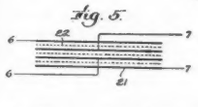


Fig. 3

Fig. 4.

Fig. 5.



in Fig. 4, also showing the preferred connection for this type of element. The principal advantages of this improved system are, unprecedented efficiency, automatic regulation and exceedingly high frequency. Each of these advantages is highly desirable and a system characterized by them all is uniquely adapted to many uses, particularly in the art of electrotherapy and radio telephony. The automatic regulation at high frequencies is of particular significance in radio telephony, since a change in the resistance of the high frequency side of the circuit has no appreciable effect upon the operation of the system, whereas in the ordinary type of high frequency circuits, a change in the resistance of the working circuit necessitates an alteration of the impedance of the circuits in order to avoid a change in the current in the working circuit.

THIS Department is conducted for the benefit of our Radio Experimenter. We shall be glad to answer here questions for the benefit of all, but we can only publish such matter of sufficient interest to all.

1. This Department cannot answer more than three questions for each correspondent.
2. Only one side of the sheet should be written upon; all matter should be typewritten or else written in ink. No attention paid to penciled matter.
3. Sketches, diagrams, etc., must be on separate sheets. This Department does not answer questions by mail free of charge.
4. Our Editors will be glad to answer any letter, at the rate of 25c for each question. If, however, questions entail considerable research work, intricate calculations, patent research, etc., a special charge will be made. Before we answer such questions, correspondents will be informed as to the price charge.

You will do the Editor a personal favor if you make your letter as brief as possible.

CRYSTAL RECEIVER.

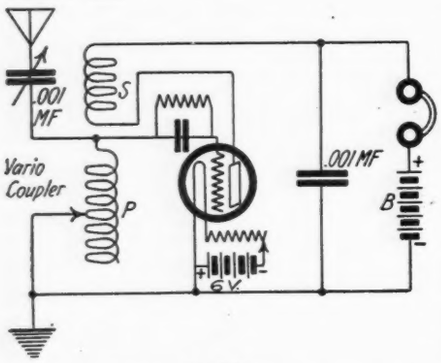
(307) P. Dellora, of New York City, N. Y., asks the following:

Q. 1. Please give a hook-up for a loose coupler, a single slide tuning coil, a variable condenser, a fixed condenser, a galena detector and phones.

A. 1. This hook-up appears on this page.

Q. 2. Could a loud speaker, as described on page 686, of the May, 1920 issue of RADIO NEWS be used with this set?

A. 2. Yes, such a loud talker could be used for strong signals, and provided a Baldwin receiver is used.



Q. 320

A Very Efficient Regenerative Set May Be Constructed Using a Vario Coupler Only, Connected as Shown Here.

HONEYCOMB CRYSTAL RECEIVER.

(308) Paul Mackie, of Pittsfield, Mass., wants to know:

Q. 1. Can I receive with a set composed of two honeycomb coils and a crystal detector?

A. 1. Yes, honeycomb coils may be used, provided a variable condenser of at least .0005 mf. is shunted across each of them.

AMPLIFIER TROUBLE.

(309) Chester Olson, of Story City, Iowa, wishes to know:

Q. 1. Why do I get weaker signals with a one-step amplifier than with a detector only? The transformer is a Sacoclad and the tube a Cunningham C300.

A. 1. The reason why you get weaker signals with your amplifier is difficult to determine without seeing the set, or even the hook-up you are using, but we suggest that you verify the windings of the transformer and also try to reverse the connection from the secondary to the grid and negative of the "A" battery.

Q. 2. Could small variometers, placed in series with the regular ones, be used to get a vernier effect?

A. 2. Yes, such small verniers could be used and may be had, ready made, from the Amrad company.

SECONDARY CONDENSER

(310) Otto A. Bedarf, of Union Hill, N. J., asks:

Q. 1. What type of variable condenser is best to shunt across the secondary of my loose coupler?

A. 1. A 23 plate variable condenser, which has a capacity of .0005 mf., is quite suitable for this purpose.

AUDIO AND RADIO FREQUENCY.

(311) Clare St. J. Moore, of Westport, Conn., would like to know:

Q. 1. What is the difference between audio and radio frequency?

A. 1. By audio frequency is meant the frequencies giving an audible sound, while radio frequency means the frequencies of the vibrations used in radio transmission, which are inaudible to the ear.

Q. 2. What is meant by DX reception?

A. 2. The letters DX are used to indicate long range work, especially between amateur stations.

Q. 3. What is the difference between an audio frequency and a modulation transformer?

A. 3. Both of these transformers work on the same principle, but vary only in their characteristics, that is, while an audio frequency transformer generally has a ratio of turns of about five or six to one between the primary and the secondary, a modulation transformer has a ratio of turns which may vary from 20 to about 50 to 1.

RENEWING V.T'S.

(312) Willard Merrill, of West Hoboken, N. J. asks:

Q. 1. Where could I have a vacuum tube filament renewed?

A. 1. We suggest that you write to the Trimount Laboratories, Milford, Mass.

AERIAL WAVE LENGTH.

(313) K. L. Long, of Riverton, Wyo., wants to know:

Q. 1. What is the approximate wave length of a two-wire inverted L aerial, 170 ft. long, with a 25-ft. lead in?

A. 1. It is difficult to tell you the wave length of such an aerial, as you do not mention the spacing between the wires, nor the distance from the ground. It should be about 220 to 240 meters.

Q. 2. What would be the efficiency of a home made, short-wave regenerative set, with a V. T. detector, and the above aerial?

A. 2. It is quite difficult to mention any range, as this depends upon the surrounding country and also upon the design of the set. Under good conditions, a range of 500 to 800 miles may be obtained.

UNDERGROUND ANTENNAE.

(314) A. W. Gregory, of Morristown, N. Y. asks:

Q. 1. Will you tell me where I could get some information regarding the method of installing underground antennae, also the advantages and disadvantages of such?

A. 1. You will find in the July, 1919 issue of RADIO NEWS, some very interesting articles on this subject, on pages 10 and 11 and also in December, 1919 issue, page 274.

HONEYCOMB COIL WINDER.

(315) Jurden Moore, of Lowell, Mich., would like to know:

Q. 1. Where could I find some data for the construction of a honeycomb coil winder?

A. 1. You will find on page 442 of the January, 1921 issue of RADIO NEWS, complete information for the construction of such a winding machine.

Q. 2. What would be the natural wave length of an aerial 500 ft. long, composed of two wires with a lead in of 60 ft. and erected 90 ft. above the ground.

A. 2. If this aerial is an inverted L type, with the wires spaced about 8 ft., the wave length is approximately 750 meters.

Q. 3. What would you consider the best regenerative set at a low price for a beginner?

A. 3. There are, at present on the market, several types of short-wave receivers, which are equally efficient when properly tuned; some of them may be bought knocked down, thus making a great saving on the price. They are furnished with full information and blue prints for assembling and we believe such a short wave set would be well adapted to your needs.

CAPACITY EFFECT.

(316) L. M. Matthews, of McClure, Ill., writes to us as follows:

Q. 1. What effect does a change in transmitting condenser capacity have on wave lengths?

A. 1. If the capacity of the condenser is increased, the wave length of the oscillating circuit is increased, and similarly, the wave length of this circuit is decreased, if the capacity itself is reduced. If any change of capacity is made in the closed circuit, the aerial circuit should be tuned for the same wave length; this may be easily accomplished by the use of a wave meter.

Q. 2. How should a stationary spark gap be adjusted to produce the maximum transmitting effect?

A. 2. The distance between the electrodes of a fixed spark gap should be adjusted so that an oscillating discharge, that is a bunch of white, heavy sparks, is obtained with a maximum distance between the electrodes.

Q. 3. Would a high secondary voltage carry farther than a lower one, if the radiation is the same?

A. 3. No; a higher voltage would not increase the range, but would increase the losses in the aerial. If the intensity in the aerial is the same, the range should be approximately the same, at low power.

HONEYCOMB COIL RECEIVER.

(317) Claude B. Vail, of Jacksonville, Ill., would like to know:

Q. 1. Why the long wave arc stations send so many V's, sometimes from 20 to over 100.

A. 1. The letter V is used by the stations while tunig, or making experiments. It has no other meaning whatsoever.

Q. 2. Where can I procure a list of the regular transmissions of the large stations in the United States?

A. 2. You will find this information in the Consolidated Radio Call Book.

Q. 3. Please give a hook-up that you consider efficient for honeycomb coils, with necessary condensers, detector tube, etc.

A. 3. You will find on page 462 of the January, 1921, RADIO NEWS, the hook-up requested.

SHORTENING AERIAL WAVE LENGTHS.

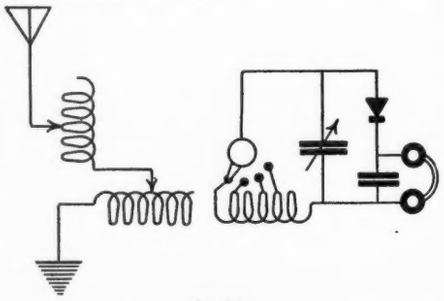
(318) Robert Briggs, of Athol, Mass., wants to know:

Q. 1. The wave length of my aerial, being about 380 meters, how could I reduce it to 200 meters without cutting down the length of the wires?

A. 1. The only way you can reduce the natural wave length of your aerial, is by inserting a condenser in series with it, but it would be much more preferable to reduce the length of the wires, as this would be much better for sending.

Q. 2. Is 56 ft. too long a lead in?

A. 2. No, provided it does not run too close to a building, trees, etc.



Q. 307

Hook-up for a Crystal Receiving Set Using a Loose Coupler and a Loading Coil; the Variable Condenser Shunting the Secondary Should Have a Capacity of .0005 M.F.

REGENERATIVE SET.

(319) Francis Fillmore, St. Louis, Mo., wants to know:

Q. 1. Which is the more efficient for tuning, a loose coupler, or a set composed of a vario-coupler and two variometers?

(Continued on page 624)

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Many of the complete "ready-to-operate" wireless sets now on the market include Murdock Phones as standard equipment. If the set you buy does not, be sure you get a set of Murdock receivers to complete your station. We strongly urge you to go to your dealer and convince yourself of the quality of Murdock receivers, by actual examination, before you buy.

Murdock Phones are the standard bearer for a complete line of "Made - by - Murdock" radio parts and instruments. This includes the famous Murdock condensers, couplers and variometers, and the new Murdock Rheostat at $1.00.

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READ PRACTICAL ELECTRICS,
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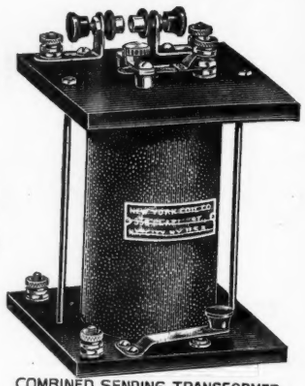
A Compact Low Power Sending Set

For the beginner who contemplates installing a transmitting set, this combined sending set will prove of interest. In this apparatus of new design is included a spark coil, a key and an air cooled spark gap, with binding posts for connections to a 4 to 12 volt battery and to the oscillating circuit, which should consist of an oscillation transformer and high tension condenser. The spark gap is of improved design and has both electrodes adjustable. The vibrator is equipped with special fixing screws so that it may be set permanently in the best operating position.

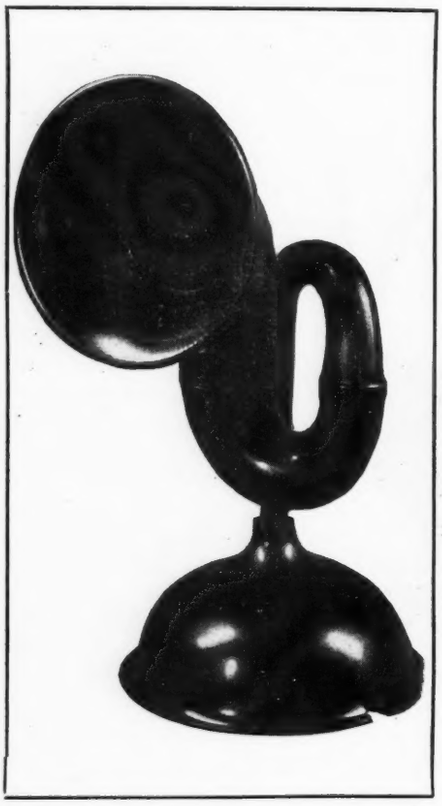
For a portable set, as used by Boy Scout Troops, or by experimenters during their vacations, this little sending outfit is ideal and may occasionally be operated with dry cells, if no other source of power is available.

Here is a combined transmitter well adapted to the amateur's needs. It is ideal for a portable set.



COMBINED SENDING TRANSFORMER, KEY, AND SPARK GAP.

A New Sound Amplifier



In an endeavor to produce a low priced loud talker, a manufacturer of radio apparatus has designed the sound amplifier shown in the photograph. The advantage of this type of sound amplifier is that any make of telephone receiver may be used in connection with it. The telephone receiver is merely mounted in the base with a screw applying it against a rubber ring, preventing any loss of sound. The screws are furnished with this instrument so that flat receivers may be used as well as amplifying types, which, of course, give best results. A notch in the base is provided for the cord of the phone, which may be simply taken out of a head set and replaced when desired.

To This Horn May be Attached Any Type of Telephone Receiver. It Gives a Great Sound Amplification When a Good Phone is Used in Conjunction With it and With an Amplifier Makes Signals That Are Readable Over a Large Area.

The complete instrument is made of brass and is either coated with black enamel, or nickel plated. Its shape gives to this sound amplifier very good amplifying properties and compared with another well-known apparatus, has proved to be equally efficient when a Baldwin receiver was inserted in the base. Of course, an amplifier is needed in connection with the receiving set in order to have a sufficient volume of sound produced by the telephone receiver, but for strong signals the instrument may be used with a detector tube only.

Club Gossip

(*Continued from page* 613)

dent, Edward Schoppe; secretary and treasurer, John H. Kerrien. Directors: John E. Kuhnast, Edward Schoppe, John H. Kerwien, Arthur E. Kerwien, Channing Ritter, W. L. King, Weston Vogel.

It was decided to hold meetings in Fort Lee High School Laboratory, but at a later date the meeting place was changed to Public School No. 2, West Fort Lee.

Harry L. Budenbender, Michael Sassano, and Gerome White have joined since.

Anyone interested in joining this club is cordially invited to be present at one of our next meetings.

For further information apply to John H. Kerwien, secretary, 2131 Center Ave., Fort Lee, N. J. Radio 2BOI.

PORT WASHINGTON, L. I., RADIO CLUB

A radio club for the benefit of residents of Port Washington, Long Island, was formed on October 22 by certain of the amateurs of the village. Considerable interest has been displayed in the welfare of the club, which has to date eighteen members, several of whom are men of prominence in the village.

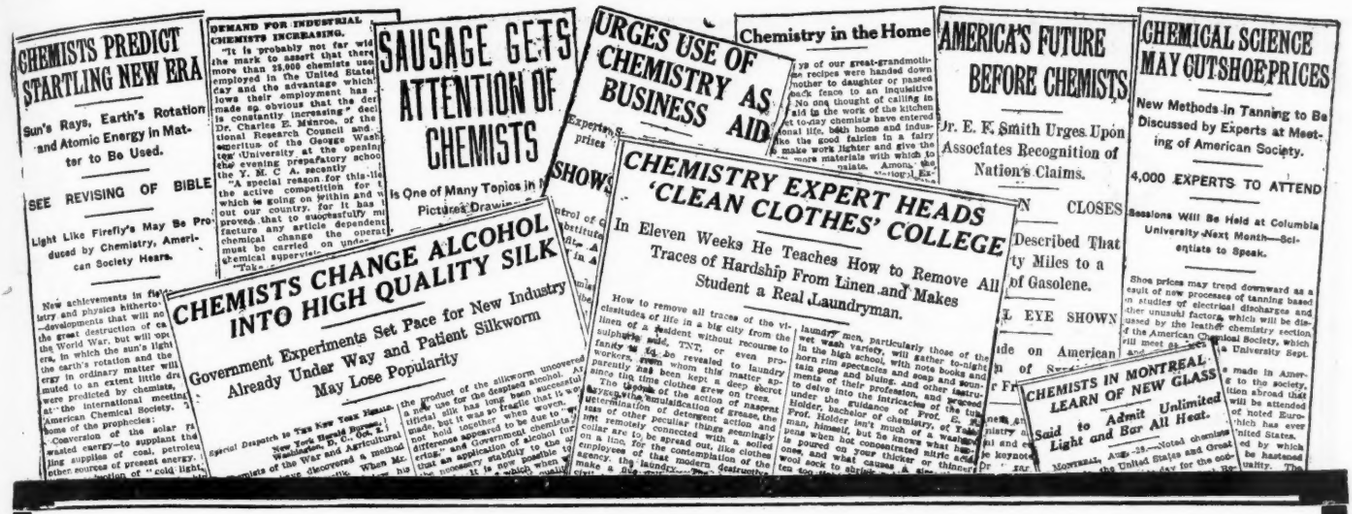
Owing to the fact that the club has been so recently formed, it has no call letter as yet, but is at present planning the installation of a transmitter. When a regular call has been obtained by the club itself, it will be announced on this page.

SYRACUSE, N. Y., AMATEUR RADIO ASSOCIATION

The Syracuse Amateur Radio Association holds meetings the 2nd and 4th Saturday every month at its club rooms. Everybody welcome. Officers are Robert Moore, president; Andrew Potter secretary; and Robert Winchester, traffic manager. Correspondence is invited by all clubs, especially those in our vicinity. Address letters to A. J. Potter, 213 Westminster Ave., Syracuse, N. Y.

TRUMBULL RADIO CLUB

The Trumbull Radio Club was organized in Niles, Ohio, for the benefit of radio men in that section. It takes in the men from Niles, Warren, Mineral Ridge, Levittsburg, McKinley Heights and the rest of Trumbull County. The club will have a set in a short time. Officers elected were Mr. J. Planty (8ANW), Niles, O., as president; Mr. Earl Baumann of Warren, O., as secretary and treasurer; Mr. Harry Donegan of Mineral Ridge, as vice-president. Communications from other clubs are invited. Address them to the Club, 5 Parkman Street, Warren, Ohio.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CHEMISTS IN MONTREAL LEARN OF NEW GLASS
Said to Admit Unlimited Light and Bar All Heat.

Chemists Are Badly Needed To-day In Every Branch of Industry

All industry to-day is three-fourths chemical. Every day brings new announcements of new ways in which chemistry is employed in business and industry. The sudden and almost unbelievable expansion of the chemical field has produced an acute scarcity of trained men. The supply of available chemists has been unable to keep pace with the increased demand. Industrial plants of all kinds pay tempting salaries to get good men—salaries of $10,000 to $15,000 a year are quite common. If you want a profession that offers unlimited possibilities—if you are looking for more money—if you like fascinating work—take up chemistry. No other vocation offers such wonderful opportunities for big money and rapid advancement. Chemistry is now recognized as the coming great science and the demand for trained men is increasing every month.

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Dr. T. O'Conor Sloane Will Teach You.

Dr. Sloane, Educational Director of the Chemical Institute of New York, is one of this country's foremost authorities on chemistry. He was formerly Treasurer of the American Chemical Society and is a practical chemist with many well-known achievements to his credit. Not only has Dr. Sloane taught chemistry for years, but he was for a long while engaged in commercial chemistry work.

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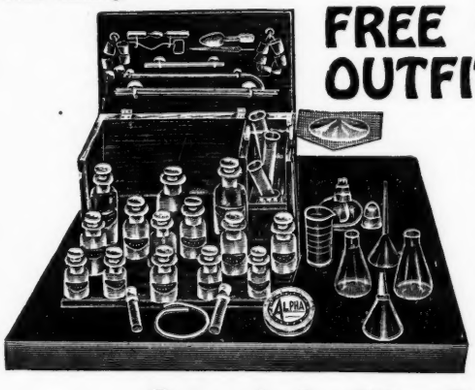

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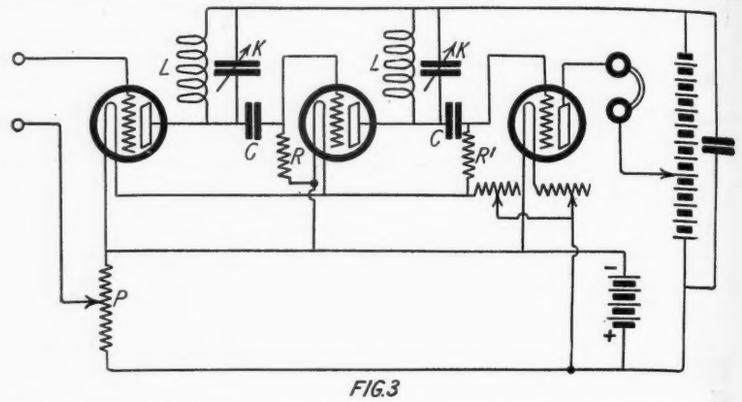
Radio Frequency Amplification

(*Continued from page 594*)



Instead of transformers tuned circuits may be used in an R.F. amplifier as a means of coupling.

FIG. 3

of this type is not practicable. A means of increasing the range of the transformers consists of shunting the primaries with small variable condensers of about .00025 m.f., although maximum amplification will be obtained on a particular wave-length.

The efficiency of the system depends upon the design of the transformers, they should be wound with fine wire and should be mounted far apart and at right angles from one another, so as to prevent reaction effects and the production of continuous oscillations, causing howling and constant whistling in the receivers. Some control of the self-oscillating properties of the amplifier can be obtained by fitting a grid potentiometer connected across the "A" battery to regulate the main grid potential of all the amplifying tubes, as shown in Fig. 2. Another precaution to prevent the tendency of self-oscillation consists in connecting across the "B" battery a large capacity, say about 2 m.f., avoiding the high frequency potentials occurring in the last tube from being induced back to the first tubes by reason of the potential drop in the resistance of the "B" battery. The condenser shown in Fig. 2 shunting the high tension battery, provides a by-pass of low impedance to the high frequency currents, reducing the high frequency potential difference, between the connection from the positive of the "B" battery to the primaries of the transformers, and the common filament connection, to a very small value.

If, instead of transformers, tuned circuits are used, as shown in Fig. 3, the oscillations are applied to the grids of the amplifying tubes through a small capacity, the value of which depends upon the wave-length to receive; for short wave-lengths, a capacity of .00025 m.f., or less, is suitable, the resistance of the grid leaks R, depending upon the type of tube used. In an amplifier of this type, either coils wound with fine wire, or honeycomb coils, may be used with good results. A special mounting may be provided for the coils so that they may be changed when it is desired to receive wave-lengths which are not included in the range of the circuit formed by the coils L, and the condenser K. If two or three stages of amplification are used, all the grids should be connected through the grid leaks R, Fig. 3, to the center tap of the potentiometer connected across the "A" battery.

IRON CORE RADIO FREQUENCY TRANSFORMERS

Another type of radio frequency transformer, which has given very good results, is the one wound on an iron core forming a closed magnetic circuit, and composed of a very great number of extremely thin laminations, which are varnished or shellacked to insulate them from each other. The windings on these transformers consist of a few turns of wire and, as in the previous case, has a maximum efficiency on a certain range of wave-length, although more uniform over the entire range than with the air core transformers. The steel used for the iron core must be of high grade, so as to reduce the losses to a minimum and the core must be of the proper size so as to have a large cross section. Such transformers are used in the L_3 amplifier designed during the late war by the French Signal Corps, the same tubes being used in this instrument to amplify at radio and audio frequency at the same time.

CONSTRUCTION OF R.F. AMPLIFIERS

For the reception of long waves, such as are used by the powerful stations in Transatlantic and Transcontinental transmissions, the resistance coupled amplifier is best adapted, as it does not require any adjustment and will give maximum results with the least trouble when used, with a loop aerial. The best type of loop to experiment with is a four or five foot square one, wound closely with about 100 turns of No. 20 D.C.C. wire, although Litz wire would prove more efficient, but also more expensive. This loop should be shunted by a variable capacity with a means of adding fixed condensers in parallel to increase the range of wave-length.

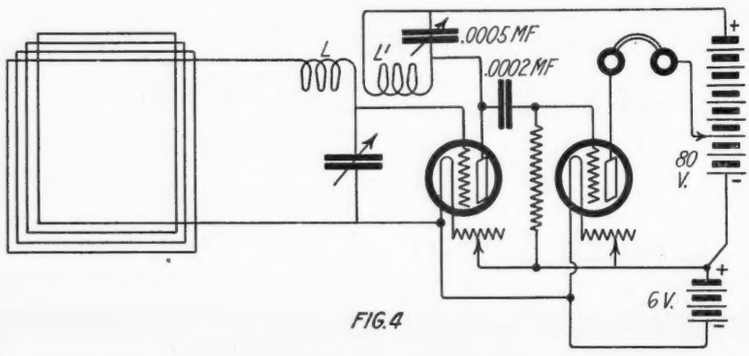


FIG. 4

A type of receiver which is well adapted to the reception of short waves. With only one step of R.F. amplification and a detector this circuit is surprisingly sensitive.

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" 50	1.50	.60
" 75	1.50	.60
" 100	1.55	.65
" 150	1.60	.70
" 200	1.65	.75
" 250	1.70	.80
" 300	1.75	.85
" 400	1.80	.90
" 500	2.00	1.00
" 600	2.15	1.15
" 750	2.35	1.35
" 1000	2.60	1.60
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The amplifier shown in Fig. 1 may consist of any number of stages of radio frequency amplification, up to six, with, if desired, one or two stages of audiofrequency amplification, using ordinary amplifying transformers between the tubes. The resistance R should have a value of 80,000 ohms and the grid leaks, of about two megohms. These grid leaks may be connected directly to the filament return connection, although it is preferable, when several tubes are used, to connect them to the slider of the potentiometer. The coupling condensers K should be of various capacities when several stages are used, in a six-stage radio frequency amplifier, the first and second coupling condensers may have a capacity of .0005 m.f., the third and fourth, of .00015 m.f., and the fifth one, of .0001 m.f. For the reception of continuous waves, the r.f. amplifier may be set to produce oscillations which, interfering with an incoming wave, produce beats, making audible the undamped waves by the autodyne method.

This is accomplished by means of a small variable condenser having one movable and two fixed plates connected as shown in Fig. 1, producing a capacity coupling between the plate of the last tube and the grid of the first one, or between the grid and the plate of the first tube for the shorter wavelengths. It is important to note that in all the types of radio frequency amplifiers, either resistance or transformer coupled AP or Myers tubes should be used, as it has been found that in other types the capacity between the elements is too great for good operation at radio frequencies.

TRANSFORMER COUPLED R. F. AMPLIFIERS

A point to which much attention should be paid is the connecting of the various elements of an R.F. amplifier, the connections should be straight and as short as practicable, so as to reduce the capacity effect and induction between the various circuits, especially with a transformer coupled amplifier. As explained before, the transformers being efficient on a rather short band of wave-lengths, several of them should be used to cover the desired range.

The number of turns for primaries and secondaries of the transformers to cover a range of wave-length from 200 up to about 20,000 meters, is given in the following table, these windings being made of very fine insulated wire on forms about 1½" in diameter with a groove about ⅛" or ¼" wide.

Primary	Secondary
70	90
80	100
120	150
200	220
375	375
650	650
1200	1200
2000	2000

These numbers of turns were found by experiments, but may not be best for an amplifier of different design as the length of the connections and the location of the transformers varies the wave-length of the circuit. They are merely given as an indication.

SOME RESULTS OBTAINED WITH R.F. AMPLIFICATION

To give an example of the sensitivity obtainable with radio frequency amplification, the following results may be mentioned: Using a loop aerial 20" square, composed of 10 turns of insulated wire spaced ¾", one stage of radio frequency amplification and detector, as shown in Fig. 4, the writer was able to receive very loudly the W.J.Z. radiophone broadcasting station, ten miles away, in a very unfavorable location among steel buildings in the downtown section of New York City. The inductance L, connected in series with the loop, consists of

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AUDIOTRON	
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CABINETS	
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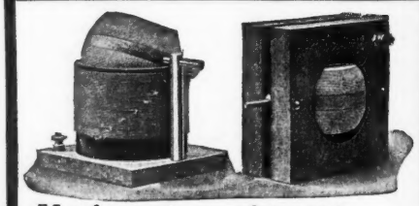

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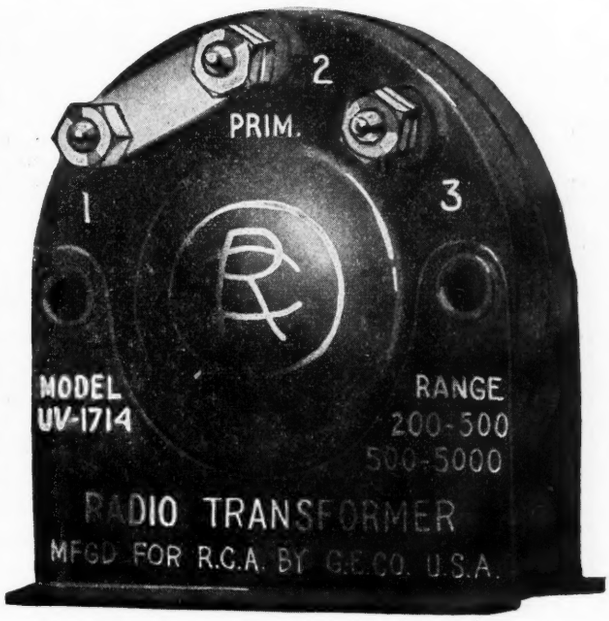
For use solely with Radiotron UV-201

UV-1714 is the model designation of this transformer—the ideal for long distance work.

It doubles and triples receiving ranges; makes audible signals that cannot be received with other types of amplification circuits; is vastly superior to any other method of amplifying telephone speech; eliminates tube noises; increases selectivity; increases signal audibility at each stage at least twenty times; makes it possible for small loops or frame aerials to receive as well as high antennae; and gives a 20-watt amateur radio telephone set the transmitting range of a transmitter of several times the power.



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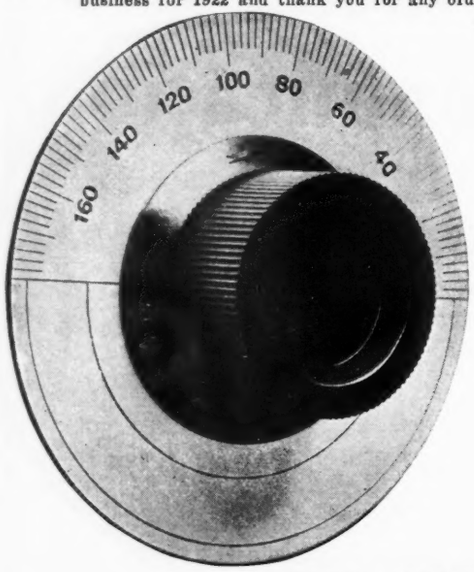

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18 turns of No. 16 D.C.C. wire wound on a cardboard tube 4" in diameter, inside of which revolves the coil L1, consisting of 60 turns of small insulated wire shunted by a variable condenser. As may be seen, this circuit is similar to the one in Fig. 3, although in this case the tuned circuit connected in the plate of the amplifying tube acts at the same time as a tickler, which may be coupled to the inductance L inserted in the loop circuit.

Two A.P. amplifying tubes were used with 80 volts on the plates, and it was possible to operate a loud talker by using two stages of audio frequency amplification so as to make the signals audible all over a very large room. Using two stages of radio frequency amplification, with tuned circuit with the coil L1 connected in the plate of the second stage of radio frequency amplification, the signals were loud on a loop 3" in diameter, which was nothing else than a small inductance wound on a cardboard tube and having the plane of its turns placed in the direction of the WJZ station.

At the present time, four types of radio frequency transformers are on the market and will certainly increase the efficiency of the amateur stations when used in the manner described in this article, although the writer does not wish to make any statement about these instruments, not having been able, as yet, to try them personally.

However, it is easy to make either a resistance or transformer coupled R.F. amplifier for use with existing apparatus, and experiments along this line will prove interesting to the Radio enthusiasts who wish to increase the range of their station.

I Want to Know

(*Continued from page* 616)

A. 1. A regenerative set with a variometer in the grid and plate circuits of the detector tube is much more efficient for tuning than an ordinary coupler.

Q. 2. Please publish a hook-up of the best of these circuits, with a V.T. detector.

A. 2. You will find on page 527, of the February, 1921, issue of RADIO NEWS, a hook-up for a regenerative set.

SIMPLEST REGENERATIVE RECEIVER.

(320) James Brown, of Boston, Mass., wants to know:

Q. 1. Which is the simplest form of regenerative receiver, that can be used for short wave reception?

A. 1. A hook-up of the simplest regenerative receiver appears on this page. It consists of a variocoupler, the primary of which is wound with 80 turns, with taps at every eight turns, and the secondary consisting of 50 turns connected in the plate circuit. A variable condenser of .001 mf. capacity should be connected in series with the aerial for fine tuning.

Radio Comes to the Aid of the Autoist

(*Continued from page* 586)

signal. For instance, the road between New York and Albany may be characterized by three dots and two dashes of the telegraph code. Other roads will be marked with other combinations.

As the signal-producing currents flow through the wire at the side of the road they will produce a magnetic field which will spread out over the highway. If a passing car had a coil of suitable design placed on its radiator, there would be produced in the coil a current as it swept through the magnetic field produced by the signal wire. There is nothing mysterious about this principle. Any coil cutting a field of force will have produced within it a current which will depend upon the number of turns of wire in

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Wave length 180-825 Meters. Perfect Regeneration at all wave lengths. No capacity effect from the hand or body. Antenna condenser built as a vernier. Compartment inside cabinet for "B" Battery or External "B" Battery may be used. The control is wonderfully simple — the best you have ever used.

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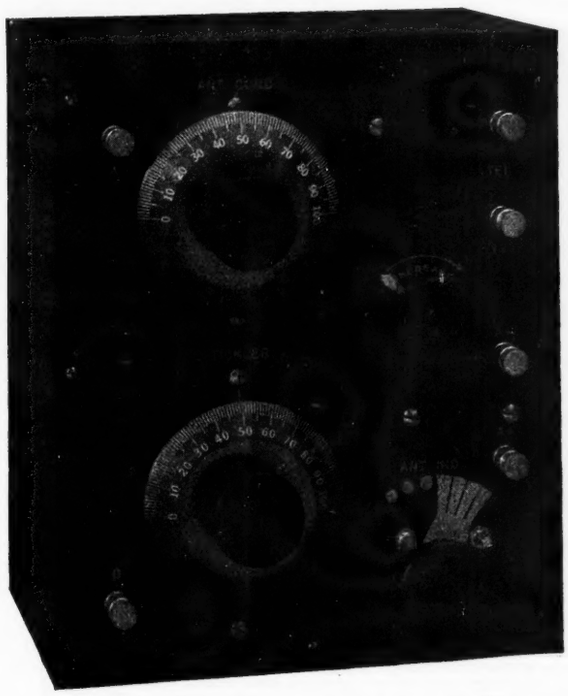

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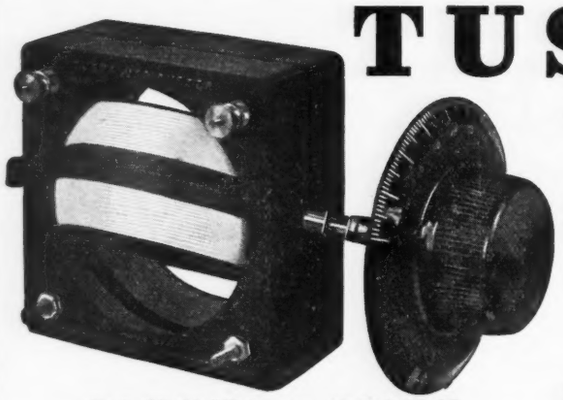

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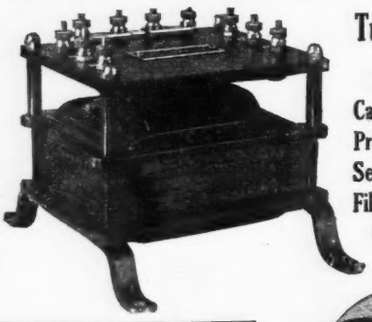

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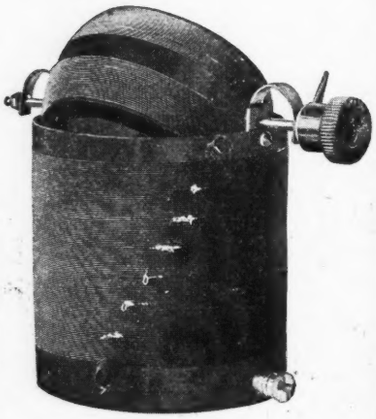

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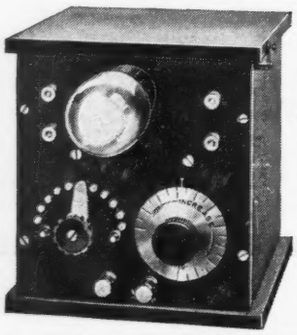

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"EVERYTHING FOR THE RADIO MAN"

the coil and the number of lines of force cut per second. In this instance, a small current is caused to flow in the coil and this is amplified with a vacuum tube.

The current from the amplifier reaches a special relay which is opened and closed with each signal emitted by the signal wire. The sensitive relay works in conjunction with the Directometer which is mounted on the dash of the car. It is on the face of the Directometer that the electrical impulses passing through the wire are registered in flaming red. This is done with small pea bulbs mounted back of red glass. One side of the Directometer registers dots while the opposite side registers dashes. Since the inventor has not as yet completed his preparations for patent protection, information regarding the operation of the Directometer itself is not yet available for publication. However, this much can be said: The construction of the instrument is simple and rugged and it will respond faithfully when it is in use on the very worst roads. The various lights behind the numerous dots and dashes on the face of the device are controlled by a special selecting apparatus which functions through the aid of the relay.

The Directometer is almost human in its action. If the instrument is set for a certain combination of signals at the beginning of a journey, a bell will ring if the driver of the car happens to get on another road having a different combination of dots and dashes. The instrument is set by simply pressing a small button located underneath the face. If, however, the route between two smaller cities is made up of a number of definite highways, which would sometimes be the case, the instrument is not set. It will then faithfully register the changing signals as the new highways are approached.

So perfect is the Directometer in its action that it will indicate a detouring point when it is reached. Two arrows, one pointing to the right and one to the left, are placed on the face of the instrument. When the detouring road is approached, one of the arrows takes on a flaming red color. This action is caused by a special signal transmitter that is placed at the point in the road where detouring is necessary. The special transmitter sends forth a special set of signals which are standard for this particular purpose. The detouring signal transmitter is made small enough so as to be conveniently portable. It can be carried from place to place nicely by a single man.

The prospective user of this device is quite naturally going to ask if the electrical devices on his car are going to interfere with the proper action of the Directometer. Since the proper action of the Directometer comes through the reception of definitely spaced characters, the electrical impulses produced by the ignition apparatus cannot interfere in any way.

The cost of the Directometer need not be fabulous, since it is not made up of complicated or delicate parts. The construction of the instrument is rugged enough to withstand the abuse of the worst kinds of roads. The inventor believes that it can be manufactured on a quantity basis to sell for a price between $50 and $75, which price would not be prohibitive considering the service the thing renders.

The C. W. Transmitter at 1 AFU

(*Continued from page* 603)

an 8/32 brass screw.

The 12 wires are cut to length and rolled into separate rolls; a piece of 2" x 3" wood is then placed on end in the center of the spreader and the clamps temporarily put on and the insulators attached to the ends

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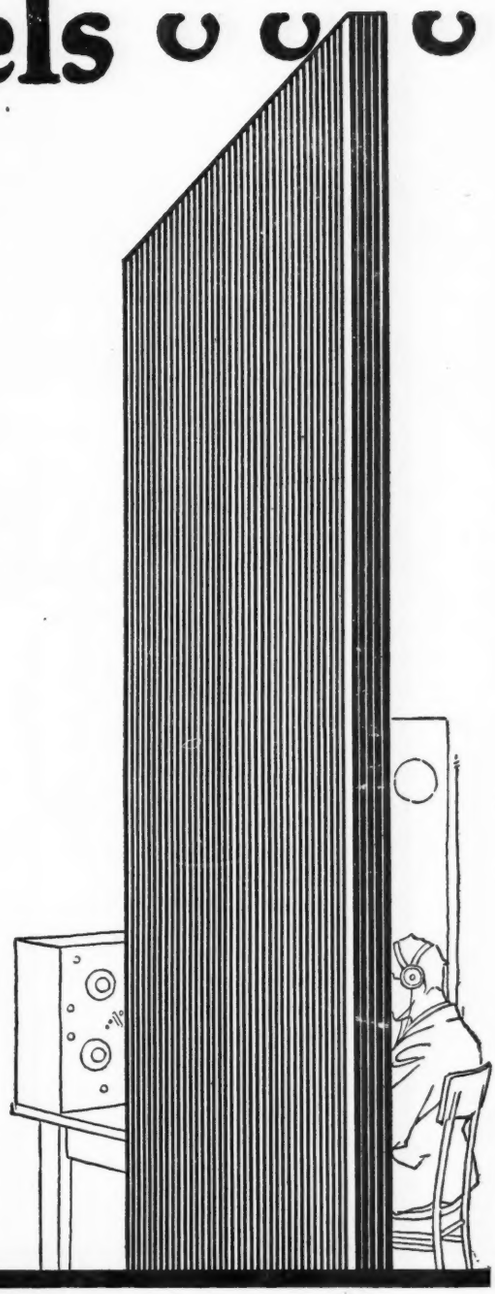

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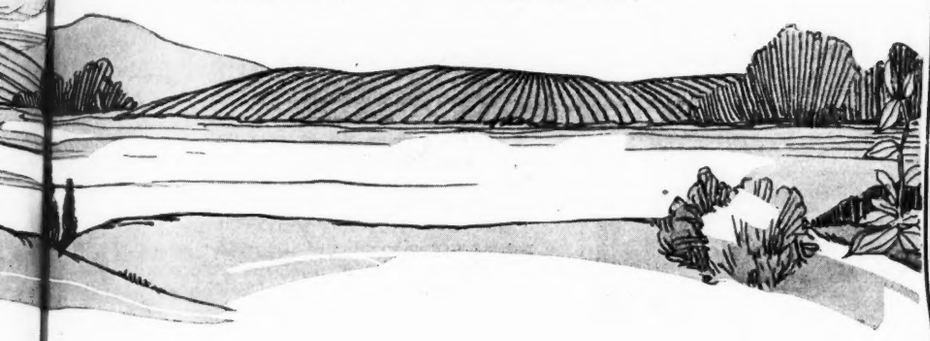

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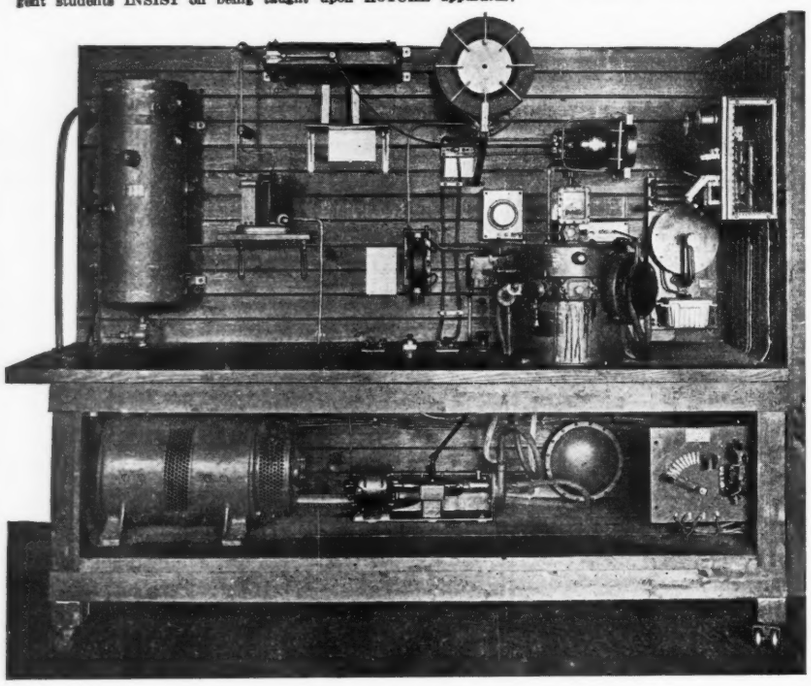

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of the straws; this part cannot be too thoroughly done for the entire weight of the antenna is supported from these four points. From the insulators the 12 antenna wires run out to the spreader, make three turns around it and drop to the lower hoop, these wires should be soldered to the spreader and hoop, but not to the hoop until after the mast is raised.

It will be necessary to dig a hole 4′ deep for all five masts and the corner posts should have a good heavy rock behind the bottom of the section in the hole and another large rock at the top of the hole in front of the mast.

To the lower section of the mast the two sets of clamps are attached 3′ apart and the back strap securely spiked in place, the guys are put onto the back straps only and this section is placed with the lower end over the hole in the ground that it will rest in. Put a plank down in the hole back of the mast and, with assistance, you can throw it into place without any trouble. Secure the guys from this section at the top to the corner also at the top, and place a good tackle at the top of the first section; assemble the two upper sections, with guys and all, and carry to the base of the section already in place; take the assembled spreader from the piece of two by three used in balancing and assembling the aerial, and put this on the topmast and unroll the 12 coils of aerial toward the base of the pole. Attach the other end of the tackle that was put on the top of the first section to a point just above the middle of the two sections now to be raised; have your assistants on the four corner guy wires and the two top sections slide easily into place by using the tackle.

With the two upper sections standing against the bottom section, it is a very easy matter to attach the tackle to the bottom of these sections and pull the entire mast up into place by releasing the guy wires as fast as the mast is pulled up.

A 6′ harpoon guy anchor is driven into the ground about 3′ back from the corner masts in line with the main mast and from the ring in the top of the guy anchor to the top of corner masts, a heavy strain insulator and a ½" turnbuckle is put in this guy. To take up the slack in the guys on the main mast all of the guy wires on the main mast are fixed securely to the top of the corner masts and these four corner masts are also used for supporting the counterpoise which consists of 10 wires running each way across the yard.

Correspondence from Readers

(*Continued from page* 614)

notes of FFZ. She's a French station here in town and sounds like a frog with a very, very bad cold. That summer (1920) I took the "shooting match" up to Mokanshan and was able to get time sigs from Shanghai 150 miles away but very faintly. That summer I met one of the Shanghai amateurs who had a pretty good set and so started in to fix up a set like his. Now radio stuff of any sort is practically impossible to get in Shanghai, we even had to use nuts with two hexagonal bolts for binding posts. I managed to scrape up the necessary junk and went to it. From some guy I managed to get a tron and so fixed up an audion detector. I used short wave honeycombs and

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for long waves I just wound several hundred feet of about No. 36. Well, it wasn't long till I had several variable condensers out from the States (I had a heck of a time getting them through the Customs), and was getting all the Pacific arcs, NPO, NPN, NPL, NPM, NPH (Vladivostock), and hanged if I didn't hear POZ and OUI. Well, that was a pretty good starter. By that time I could read pretty good, but wasn't able to get much regularly. By the way, in the States NPL would be considered *pretty* good receiving, 7,500 miles. Since then I've kept on adding and have been doing better work all the time. Of course, there are the breaks which every Ham makes, I suppose. Because I didn't have enough B battery one day, I thought it was the fault of not having enough filament current and put two six volt storage batteries in series. Of course the filament went gaphlooey (French for burnt out), and so did I for the time being. Last spring I made a two-step amplifier and got some Clapp-Eastham coils out from America. I took the whole set up to Mokanshan this summer and just about wrecked it. The weather up there was very damp and before long the primary of one transformer had snapped. Two weeks later the other followed suit. The storage battery for the filaments had a plate buckle and of course that knocked the whole business out. Since getting back to Shanghai I have had everything fixed up. One transformer is in the repair shop, but will be in the panel again in a few days. Of course, I have made a new detector and tuner panel. I'll send you a picture of the set when I take it: This fall I have been able to copy press from San Diego, NPL, every day at six o'clock. That's pretty good work. I also can get NPG very clearly. From your American standards that's unusual reception. The two-step makes the sigs sound all over the place. I have also heard European stations besides POZ and OUI, FL, YN, LY and IDO. My heart's set on getting NSS. I hear NPL doing a lot of business with him, but haven't ever heard him. By the way, I use the same old coils I made a year ago. They are just made out of a hunk of fiber for a core and sides and about No. 36 wire. The winding is done all criss-cross without any order or sections. I take the RADIO NEWS and, of course, see all about honeycombs and fancy tuners. I *know* these things of mine are as good as honeycombs and I'll stake them against any tuner made. They do as good work as the Navy sets anyway. Of course, using a tron helps a lot. They have a Western Electric beaten two ways and back again. I use VT-1's for amplifying. I haven't done anything with a transmitter because there isn't anybody outside of this city to send to. Anyway, the expense is quite heavy for the use and upkeep of a good spark set. I am doing some experimenting with C.W. though and expect to build a C.W. transmitter of some sort.

I'd be glad to correspond with any amateurs you know. There's lots to tell about the ether around this burg.

EDWARD T. LOCKWOOD,
Shanghai, China.

The Radio Direction Finder

(*Continued from page* 588)

on each side. The two terminals of the coil are connected directly to a tuning condenser and also to the grid and filament of the detector tube. Means should be provided for putting the detector tube into the oscillating state by coupling the plate circuit into the loop circuit by means of a small coil of few turns in series with the direction finder coil. With a tuning condenser of 0.0007 microfarad capacity it should be possible to tune to wave-lengths

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No. QO Clapp-Eastham, fully mounted	5.00
No. 50 Chelsea, new type	4.50

ANTENNA WIRE

"Pittsco" No. 14 hard drawn copper (80 ft. per lb.) per lb.	0.40
500 ft. special value at	2.25
"Pittsco" 7 strand No. 22 tinned copper, per ft.	0.01
500 ft.	4.25
1000 ft. Special value at	7.50
"Pittsco" 7 strand No. 20 phosphor bronze, per ft.	0.02
500 ft. special value at	7.50

"B" BATTERIES

No. 7623 Standard 22.5 volts, small	1.50
No. 7625 Standard 22.5 volts, large	2.65
No. 7600 Standard 22.5 volts, variable, 16½ to 22½ volts	3.00
No. 7650 Standard 22.5 volts, large, variable, 15 variations	3.50
No. 763 Everready 22.5 volts, small	2.25
No. 766 Everready 22.5 volts, large, 16½ to 22½ volts	3.00
No. 627 Ace, 45 volts, variable	3.50

COILS (Duo-Lateral)

DL-25	$1.40	DL-300	1.75
DL-35	1.40	DL-400	1.80
DL-50	1.50	DL-500	2.00
DL-75	1.50	DL-600	2.15
DL-100	1.55	DL-750	2.35
DL-150	1.60	DL-1000	2.60
DL-200	1.65	DL-1250	3.00
DL-250	1.70	DL-1500	3.50

COIL MOUNTINGS

No. LC-100 De Forest 3 coil mounting with gears, reduced price	6.00
No. LC-101 De Forest 3 coil mounting with gears and wooden base	9.50
No. 400 Remler 3 coil mounting with base and extension handles	6.50

CONDENSERS (For CW work)

No. UC-1014 Radio Corp. .002 MF. 3000 volts	2.00
No. UC-1015 Radio Corp. .0003, .0004, .0005 MFD. 7500 volts	5.40
No. UC-1803 Radio Corp. .000025 MF. 10,000 volts	5.00
No. UC-1806 Radio Corp. .002 MF. 6,000 volts	7.00

CONDENSERS (Grid and Plate Types)

No. UC-570 Radio Corp. .0025 MF.	2.00
No. UC-569 Radio Corp. .001 MF.	1.50
No. UC-568 Radio Corp. .0005 MF.	1.35
No. UC-567 Radio Corp. .00025 MF.	1.20
No. UX-543 Radio Corp. Condenser Mtg.	.50

CONDENSERS (Filter Type)

No. UC-1631 Radio Corp. .5 MF. 750 volts	1.35
No. UC-1632 Radio Corp. 1 MF. 750 volts	1.85
No. UC-1634 Radio Corp. .5 MF. 1750 volts	1.50
No. UC-1635 Radio Corp. 1 MF. 1750 volts	2.00

C.W. INDUCTANCES

No. UL-1008 Radio Corp.	11.00
No. P-1 Acme	8.00

C.W. POWER TRANSFORMERS

No. UP-1638 Radio Corp. 325 watts	25.00
No. UP-1016 Radio Corp. 750 watts	38.50
Acme 200 watt 350-550 volts, Mtd.	20.00
Acme 200 watt 350-550 volts, unmtd.	16.00

FILTER REACTORS

No. UP-1626 160 Milliamperes	11.50
No. UP-1627 300 Milliamperes	15.75

GRID LEAKS (Radio Corporation)

No. UP-1719 for 5 watt tubes	1.10
No. UP-1718 for 50 watt tubes	1.65
No. UP-516 ½, 1, 1.5, 2 or 3 megohms each complete with mounting	1.25
Grid leaks only, each	.75

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No. P-1 Roller-Smith 0-2.5 amperes, flush mtg. Special value at	4.75
No. UM-530 Radio Corp. 0-2.5 amperes	6.00
No. UM-533 Radio Corp. 0-5 amperes	6.25

JACKS (Radio Type)

No. 61 Pacent open jack	.70
No. 62 Pacent closed jack	.85
No. 63 Pacent 2 circuit	1.00
No. 65 Pacent three spring automatic filament control type	1.20
No. 66 Pacent five spring A. F. C.	1.50

LOUD SPEAKERS

No. R-3 Radio Magnavox, new type horn, very latest model	45.00
No. P-1 Vocaloud, station type	30.00
No. 400-W Federal Pleiophone	14.00

MAGNETIC MODULATORS

No. UT-1643 ½ to 1½ amperes	9.50
No. UT-1357 1½ to 3½ amperes	12.50
No. UT-1367 3½ to 5 amperes	17.00

RECEIVING SETS (Crystal)

"Aeriola Jr." Westinghouse, complete with Brandes "Superior" phones	25.00
"Radiola" De Forest, complete with Brandes "Superior" phones	25.00
Radio Service Type S-8 without phones, splendid value	7.50

RECTIFYING DEVICES

No. UV-216 Radio Corp. "Kenotron" 20 watt type for UV-202 tubes	7.50
No. UV-217 Radio Corp. "Kenotron" 150 watt type for UV-203 tubes	26.50
No. P-1 DeForest 20 watt rectifying tube for use with 5 watt tubes	7.00

RECTIFYING DEVICES (for "A" Batteries)

No. P-1 Tungar, 5 ampere type, complete with bulb	28.00
No. P-2 Tungar, 2 ampere type with bulb	18.00
No. P-3 FF Battery Booster, 5 amp. type	15.00

REGENERATIVE RECEIVERS

No. CR-3 Grebe "Relay-Special" 175-680 meters	65.00
No. CR-5 Grebe 175-3000 meters, "Super-special" complete set	80.00
No. CR-8 Grebe 175-1000 meters, complete set, latest "Relay Special"	80.00
No. CR-9 Grebe 175-3000 meters, complete set with det. and 2 stage amplifier, self contained, "A Masterpiece"	130.00
No. RA Westinghouse, 180-700 meters, very selective, mahogany cabinet	65.00
No. RC Westinghouse, RA receiver and DA Det. Amplifier combined in one cabinet, a splendid unit, compact	125.00

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No. 56 Murdock 2000 ohm double	5.00
No. 56 Murdock 3000 ohm double	8.00
No. CW-834 Western Electric 2200 ohms	15.00
Brandes, "Superior" with new headband	8.00
Brandes "Trans-Atlantics" with new headband	12.00
Brandes "Navy Type" with new headband	14.00
Baldwins Type C	12.00
Baldwins Type E	18.00
Baldwins Type F	14.00
Baldwins Type C unit only	6.00
Federal A. and N. Type 2200 ohms	8.00
Federal A. and N. Type 3200 ohms	10.50

VACUUM TUBES

No. UV-200 Radiotron detector	5.00
No. UV-201 Radiotron amplifier	6.50
No. UV-202 Radiotron 5 watt	8.00
No. UV-203 Radiotron 50 watt	30.00
No. UV-204 Radiotron 250 watt	110.00

Note:—All Radiotrons sent postage and insurance prepa'd anywhere in U. S. A. Send us your orders for Radiotrons.

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Discriminating Radio Men Insist On TELMACO

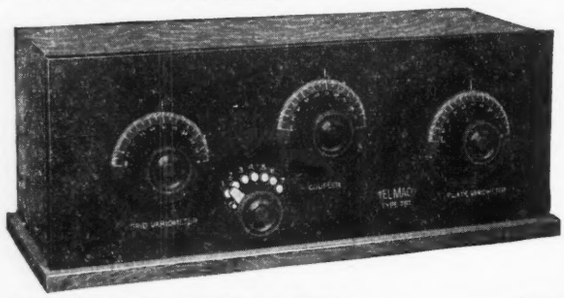
Telmaco Short Wave Receivers Unwired Type TR-1

Telmaco's policy is to give better values. That is why we are forced to work overtime to fill orders. Last month we were compelled to make slight delays in shipments in a few instances. This we very much regret. We have now increased our facilities so that everybody will receive his Telmaco Apparatus promptly.

The Telmaco Short-Wave Receivers are completely assembled; lugs are in place on which to solder wires; No. 14 silver finished wire, as well as necessary tubing is furnished.

The Cabinet is constructed of quarter sawed oak, stained inside and out, with waxed finish. **Panel** is of grade M 3/16 in. **Formica,** 6⅛ in. x 16¾ in., satin grained finish, mounted on special drawer sub-base. Metal parts are nickel plated and oxidized. **Binding Post Construction** is of **Telmaco** special design extending through back of cabinet, thus removing all external wiring from front of panel.

TELMACO VARIOMETERS AND VARIOCOUPLER with flush type bearing plates and spring washer bearing contactors are used, thus assuring perfect electrical connections permanently for ball windings without "pig-tailing." **Dials** are Remler 3 in. polished molded bakelite. **Lettering** on panel is pantograph machine engraved, filled with the best grade white enamel.



Telmaco Amplifiers and Detectors

Type TDA-1 Telmaco Detector and Single Stage Amplifier Unit $35.00
Type TA-2 Telmaco Two-Stage Amplifier ... 40.00
Type TDA-2 Telmaco Detector and Two-Stage Amplifier 45.00

Order direct from this ad.

Satisfaction guaranteed always or money refunded. Send for our complete catalog "N". You'll find it interesting.

TR-1 Telmaco Short Wave Receiver, Unwired.....$35.00
TRD-1 Telmaco Short Wave Receiver and Detector, Combined, Unwired $45.00

DEALERS! We are distributors for nearly all Standard Lines. Write for our Special Proposition.

Your panels engraved with our **GORTON ENGRAVER.** Price 5 cents per letter. **Minimum charge $2.00.**

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from 400 to 800 meters. With a 0.0015 microfarad condenser 1,000 meters may be tuned.

Twelve turns in place of eight with the 0.0007 microfarad condenser will enable one to tune to 1,000 meters also.

When the coil is tuned in the direction for maximum signal, distances of a few miles may be covered when using a crystal detector, but to operate satisfactorily a sensitive electron tube detector should be used, or even better an electron tube detector and one or two stages of audio amplification. With the two-stage amplifier a range of 25 miles or so should be obtained. A type of radio direction finder recently installed on the Lighthouse Tender *Tulip* by the Bureau of Standards and the Bureau of Lighthouses makes use of a six-step amplifier containing three radio stages, a detector, and two audio stages. In this radio compass, the bearings are read directly on the card of the magnetic compass. This radio compass has a range of fifty miles when using the minimum method described below, and has an accuracy of two or three degrees. This radio compass with reading device is shown in Fig. 2. Direction finders for use on shipboard are now on the market.

OPERATION

To take a bearing, a station should first be tuned in. If no signal is heard, turn the coil 90 degrees. The operator should grasp the coil in both hands, holding it vertically in front of him. This will be found the easiest and most natural position in which to operate the coil.

As the coil is rotated about a vertical axis, it will be found that the signal dies out over a certain sector of the revolution, then increases in strength to a maximum, decreases, and dies out again. This cycle is repeated twice as the coil is rotated through 360 degrees. Signals from a given transmitting station will be heard most strongly when the coil is turned in the direction of that station, and the signal dies out when the plane of the coil is at right angles to the direction of the transmitting station. With a fairly strong signal, the direction of a transmitting station can thus be determined by setting on either the position of the coil for maximum signal, or the position for minimum signal. In general, for a strong signal the minimum method can be expected to give more accurate directions. With a weak signal, or with receiving apparatus of comparatively small sensitivity, it is preferable to set on the maximum signal.

In using the minimum method, as the coil is rotated through the silent zone, the two extreme positions where the signal becomes just audible, should be noted. The coil is then turned to the position in the silent zone half way between these points. The direction to the transmitting station is then approximately on a line lying at right angles to the plane of the coil, that is, either in front or to the rear of the operator provided he turns with the coil. With care, and practice, directions may thus be determined to within five or ten degrees. The nearer the transmitting station and the louder the signal the greater the accuracy.

The maximum method should be used in cases in which the sector over which the signal is inaudible is greater than the sector over which it is heard, that is, the latter sector should be used. Set the coil in the position where the signal is strongest, the transmitting station is then either directly to the operator's right or to his left, that is, in a line along the plane of the coil.

It is important to realize that bearings obtained with the direction finder located in metallic frame buildings, or near trolley, power, or telephone lines are liable to be in error due to the distortional effect.. This error may amount in some cases to from

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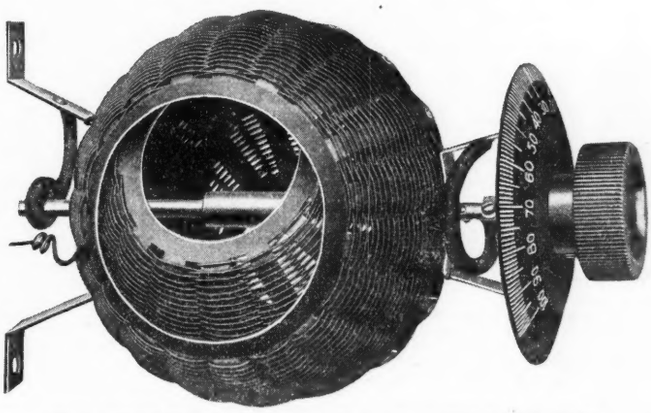
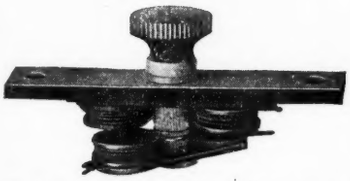


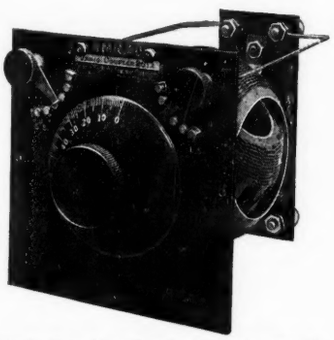
Louder Signals

New Amrad Variometer (Basketweave) as Illustrated, $6.75. Without Knob and Dial, $6.10. Described in Bulletin O.



Vernier Variometer, $1.50. Bulletin N

Ampliformer, $6.00. Bulletin N.



Vario-Coupler, Semi-Mounted, $13.00. Unmounted, $6.10. Bulletin O.

THESE Amrad Radio Products were designed and manufactured by the American Radio and Research Corporation which has already produced over $700,000.00 worth of specialized radio equipment for the U. S. Government.

Referring to the development of a submarine detector for the Government, the Naval Consulting Board (Thomas A. Edison, Chairman) wrote:

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Synchronous Motor, $25.00. Bulletin T.

Fixed Condenser, All Capacities, $.45 each. Bulletin N

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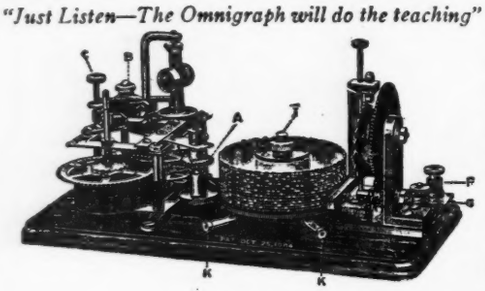
"Just Listen—The Omnigraph will do the teaching"



The Omnigraph is an *Automatic* Transmitter that teaches you both the Wireless and Morse Codes, at home, without any expense except the cost of the machine itself. Merely connect to battery and your Buzzer, or Buzzer and Head Phones, or to your Sounder and the Omnigraph will send unlimited messages by the hour, *at any speed* you desire.

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For a few dollars you can have a complete outfit that will make you an experienced operator in the shortest possible time. No hard, laborious work—just learn by listening. The Omnigraph is adjustable so you can start receiving messages slowly, gradually increasing the speed as you become proficient.

You'll be surprised how quickly you will attain speed. Even if you are already an operator the Omnigraph will help you. It will make you more proficient, more accurate and more confident. Thousands of Omnigraphs are in use today and thousands of operators owe their success to them.

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We also manufacture the OMNIGRAPH RADIO RECEIVING SET. A complete Vacuum Tube Set including Tube, a pair of 2,000 ohm Phones, A and B batteries, Aerial Wire, Safety Switch, Insulators and Ground Clamp. All enclosed in a carrying case, handsome enough to install in your parlor or sitting room. Price $48.00. Nothing to approach it at anything near the price. No previous knowledge of wireless required. Set comes to you completely wired. Nothing additional to purchase. Just erect your Aerial, place the Phones to your ears and listen-in. Absolutely guaranteed.

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The new "Ace" No. 627-45 Volt Variable "B" Battery is rapidly creating a remarkable reputation as to "Price," Quality, Service and Weight. The special size cell construction guarantees from 50% to 75% longer life than any 2 small size "B" Batteries. 16 Taps, 30 Voltage readings of from 1½ to 45 Volts obtained. Absolutely the best "B" Battery offer ever made. Size 6 in. x 5 in. x 2¾ in.—weight 3¾ lbs. Price $3.50. Demand "ACE." If your dealer does not carry "Ace," write to us. This list contains the six popular type "ACE" "B" Batteries.

Cat. No.		Size	Voltage	Lbs.	Taps.	Price
623	Plain	2½x2x2¾	22½	1		$1.50
623	Variable	2½x2x3¾	22½	1	5	1.75
625	Plain	3 x4x6¾	22½	5		2.50
625	Variable	3 x4x6¾	22½	5	5	3.00
626	Plain	3 x5x6¾	45	10		5.00
626	Variable	3 x5x6¾	45	10	6	6.00

Write for Catalog No. 20

Ace Batteries are silent, moisture proof and absolutely guaranteed.

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10 or 20 degrees and may be corrected by proper calibration.

In the case of the shipboard type of direction finder when taking a bearing, it is important that the ship's antenna be grounded and that the compass coil be as free as possible from metallic guys, wires, etc.

The distortion of the radio wave due to the ship's mass may introduce an error of from 10 to 20 degrees. This error will generally be a maximum when the transmitting station lies on a line at 45 degrees to the ship's center line. With the signal coming from fore, aft, starboard or port, the wave distortion is practically zero. This error is overcome by a proper calibration so that corrections may be made for the effect of the ship in distorting the wave.

Information regarding the operation of the radio compass is contained in a publication of the Bureau of Standards now in press, "The Radio Direction Finder and Its Application to Navigation."

A Relay Key

(*Continued from page* 601)

have undue attraction for D when the local circuit is closed.

By virtue of its construction, it will be found that this compact little key will successfully handle the fastest vibroplex transmitter at very heavy amperages.

A 150-20,000 Meter Receiver

(*Continued from page* 599)

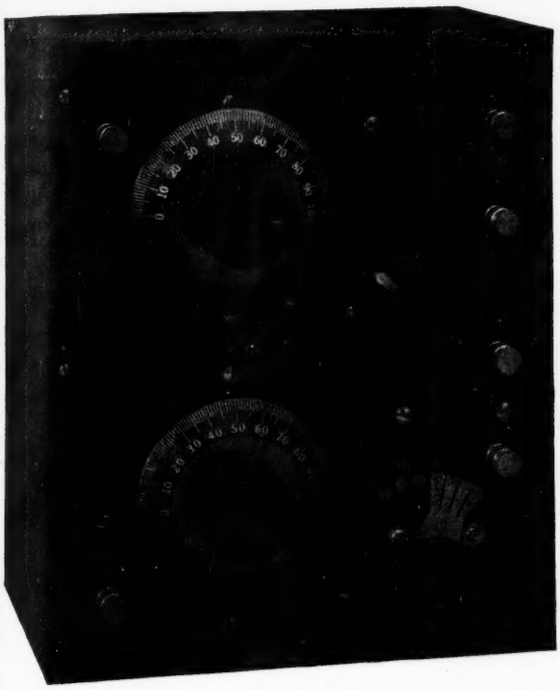
small loop may be twisted outward when a tap position is reached. Leads are later soldered into these loops. Coil B is wound the same, but it is not tapped. Both coils are heavily varnished after removing the cords.

Three-inch diameter bakelite tubes, each 2" long are used for tickler and primary coupling coils. The tickler is especially mounted so the winding is not divided to pass the rotating rod. Three layers bank wound with No. 28 D.C. wire are wound into a length of 1¼" for the tickler. The primary winding is divided to pass the rotating rod. Each winding is ½" long, two-layer bank wound with No. 24 cotton, making about 45 turns in all.

A small adjustable condenser in three steps is also explained in the sketch. This device is quite important to successful manipulation with some types of detecting units. Any of the three values may be selected by a small switch on the panel front. The condenser is clamped between two bakelite blocks 1½" x 2" as shown in Fig. 7. Eleven copper-foil surfaces are required cut ¾" x 1¼" with projecting tabs, as shown by the dotted lines for the different groups. Mica sheets cut 1½" x 2" separate the foil plates. The method of grouping into the three capacities is shown by a small diagram at Fig. 8. After stacking the condensers, they are clamped between two rectangular blocks of bakelite. Tabs are bent downward and small machine screws are threaded into the block base as shown. Mica of 2 mil thickness will give good service, although the actual thickness is not important. This method of building up very small condensers has proved very satisfactory, as they are compact and strongly built; they prove very effective in other forms of circuits and may easily be made up by experimenters.

All parts are mounted directly upon a

The Most Remarkable Value Ever Offered



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Special Features —

Wavelength 180 - 825 meters.
Ant. Cond. built as Vernier.
"B" Battery box *inside*.
Simplest possible control.
Cabinet 7¾" x 9⅜" x 6¾.
***Guaranteed* to give results.**

$35

Delivery Prepaid

This brand new unit, of amazingly simple design and careful construction "covers" remarkable distances with a loudness and clearness surprising even to the most experienced operator. It is compact, accurately adjusted and probably the simplest controlled set yet presented for amateur use. Its workmanship throughout is of the highest order. **Panel.** Formica, dull finished and machine engraved; **Cabinet:** Dark Oak heavily varnished, with hinged compartment for "B" Battery. (External "B" Battery may be used if preferred); **Condenser:** Balanced type, 2 rotary and 3 stationary plates; **Antenna Inductance** wound on Formica Tube; **Plate Inductance:** Wound on Moulded Ball.

SET IS GUARANTEED SUPERIOR TO ANY ON MARKET

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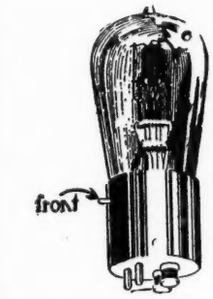

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SAFETY FUSE

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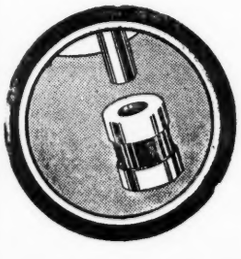

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(By mail or from dealer)

Capacity, 1, 1¼, 1½, 2, 2½, 3 amps.

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Windings in place 1.20
Bakelite Tubes wound for primary variocoupler..... 1.20
Variometer and variocoupler balls with axles and wound 1.20
Oak cabinets 7 x 18 x 6" deep.....$3.50
" " 12 x 14 x 6" deep..... 4.00
" " 10 x 7 x 6" deep..... 2.25
" " 12 x 7 x 6" deep..... 2.50
" " 7 x 7 x 6" deep..... 1.80
" " 6 x 14 x 6" deep..... 2.80

Dealers Write for Proposition

MEADE BAKELITE & RADIO APPARATUS

942-944 Jefferson Ave., Brooklyn, N. Y.

SPECIAL COMBINATION

"A" Storage Battery with Cunningham Tube C 300

Volts	Amps.	Battery only	With C300 Tube
6	40	$9.90	$14.50
6	60	12.65	17.15
6	80	13.95	18.45
6	100	17.50	22.00
6	120	19.95	24.45

All batteries fully guaranteed for one year.
Tube only, prepaid, $5.00. Batteries by express collect.

JACKSON BATTERY CO., 1124 JACKSON BLVD. CHICAGO, ILL.

A Good Way to Spend Your Xmas Check

Invest it in a Brandes Headset; something out of which you can get daily pleasure for years to come.

Brandes Headsets are scientifically designed; constructed by experts; mechanically perfect in every detail.

In professional, scientific and amateur use all over the world. Proving satisfactory under all conditions.

"Navy" type headset $14.00
"Superior" type headset . . . . . $ 8.00

Sold on 10 days' trial. Money refunded if not satisfactory. Send 5c for catalog G.

DEALERS, Write for our Proposition.

C. BRANDES, Inc.
Room 823, 32 Union Sq., N. Y. City

BRANDES Matched-Tone HEADSETS

LEARN WIRELESS AT HOME

The Demand for Good Wireless Operators Far Exceeds the Supply

The New York Wireless Institute will make you an operator—AT HOME—in your spare time—quickly, easily and thoroughly. No previous training or experience required. Our Home Study Course has been prepared by Radio Experts. Experts able to impart their practical and technical knowledge to YOU in an easy to understand way. The graded lessons mailed you will prove so fascinating that you will be eager for the next one. The instruments furnished free, will make it as easy to learn the Code as it was to learn to talk. All you will have to do, is to listen.

TRAVEL THE WORLD OVER

A Wireless Operator can visit all parts of the world and receive fine pay and maintenance at the same time. Do you prefer a steady position without travel? There are many opportunities at the numerous land stations or with the Commercial Wireless or Steamship Companies.

FREE INSTRUMENTS AND TEXT BOOKS

This wonderful Set for learning the Code furnished FREE with our Course

We furnish free to all students, during the course, the wonderful receiving and sending set exactly as produced in the illustration. This set is not loaned, but GIVEN to all students completing the Course.

The Transmitter shown is the celebrated Omnigraph used by several Departments of the U. S. Government and by the leading Universities, Colleges, Technical and Telegraph Schools throughout the U. S. and Canada. Start the Omnigraph, place the phone to your ear and this remarkable invention will send you Wireless Messages, the same as though you were receiving them, through the air, from a Wireless Station hundreds of miles away. When you apply for your license, the U. S. Government will test you with the Omnigraph—the same model Omnigraph as we furnish to our students. Ask any U. S. Radio Inspector to verify this.

FREE Post-Graduate Course

A one month's Post-Graduate Course, if you so desire, at one of the largest Wireless Schools in N. Y. City, New York—the Wonder City—the largest port in the World and the Headquarters of every leading Wireless and Steamship Company.

BIG SALARIES

Wireless operators receive salaries from $125 to $200 a month and it is only a stepping stone to better positions. There is practically no limit to your earning power Men who but yesterday were Wireless Operators are now holding positions as Radio Engineers, Radio Inspectors, Radio Salesmen at salaries up to $5,000 a year.

EASY PAYMENTS

A small payment down will enroll you. We will make the payments so easy that anyone ambitious to enter the fastest growing profession—Wireless—may do so.

Send for FREE Booklet

Without obligating you in any way, send for our booklet "How to Become an Expert Wireless Operator"—it is free. Mail the coupon below, or postal or better—but do it today.

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Send me, free of charge, your booklet "How to Become an Expert Wireless Operator," containing full particulars of your Course, including your Free Instrument offer.

Name .....

Address .....

City or Town..... State.....

formica panel measuring 14" x 24". All scales and numerals are engraved directly into the panel and filled with enamel, but the use of dials will be very satisfactory if the builder uses them. Both condensers are Clapp-Eastham balanced variety. Federal key-switch and jacks were used, although any similar variety of jack would prove efficient.

A Novel "B" Storage Battery

(*Continued from page* 599)

view, thus making it hard to tell at a glance which cells need refilling. The solution in each cell can of course be seen from the top, but at this angle it is difficult to judge how full the cell is, especially with plates, etc., in position.

Positive and negative plates for a battery of the kind, which is being described here can be made in several styles, and can be formed by constant charging and discharging. Pasted plates being a little too complicated for a battery of this size, the next best style to use is a perforated or corrugated plate. These can be made very readily from thin sheet lead, the surface of which may be roughened by stamping with a check protecting perforator or some similar device. Such plates are far superior to smooth lead in all respects, and give greater capacity and much longer life to the cell.

When making battery plates for any storage cell, care must be taken not to use too much lead for the amount of solution which will be present. In small batteries not more than one-quarter to one-third of the cell space should be taken up by lead, and about half as much by separators, otherwise excessive boiling, etc., will take place, and the cell will not take a decent charge. Plates for the cells in mind can be made from lead about 1/32" thick or less, ½" wide and 6" long. These can be bent double, forming two plates with the necessary connection for use between cells. Two of these can be put between each cell, making four plates per cell.

Sufficient lead for a fairly strong battery can be got in a plate ½" x ½" x 1/16", two being used per cell. A number of these plates connected in series can be charged from a 110-volt circuit, provided a lamp of not over 25 watts is placed in circuit as a resistance. Where alternating current is used, a single cell electrolytic rectifier must be used in series also.

Thin wooden separators will be found satisfactory for the cells which have been described here. These can be bought for a few cents from most any battery service station and cut into narrow strips suitable for the miniature cells.

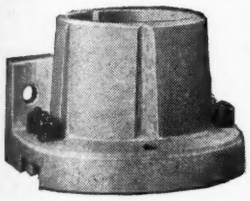
The usual acid and water solution with a specific gravity of about 1250 deg. should be used in the small cells under consideration, and in charging the battery it will be found necessary to add quite a bit of distilled water from time to time, especially until the plates are thoroughly formed, which means after they have been well charged and discharged 30 or 40 times for a period of say 25 minutes each. This may sound like a good deal of fussy work, but the average experimenter will find it very interesting, as the battery can be discharged through small meters, 'phones, etc., and a record of some of the tests plotted to show the improvement in the plates, as the charging and discharging continues.

In addition to the original view of the battery container, which shows a snug-fitting metal bottom attached, supplementary illustrations showing a few plates and separators in place, and also a rubber tubing filler cap holder are shown. The latter are simply short pieces of ½" rubber tubing

Crosley V-T Socket

60c

"Better -- Costs Less"



The reason for its tremendous success is not low price, but because it is BETTER. The bayonet catch is now imbedded in a much heavier wall instead of being cut clear through. This eliminates the possibility of breakage through careless handling. The whole socket has been greatly reinforced. It is now practically unbreakable. Dropping it on the floor will not break it. The springs are phosphor bronze, nickel plated; screws and nuts brass nickel plated.

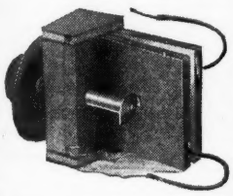
It is built for base or panel mounting, an exclusive feature. It is the prettiest thing you ever saw assembled in a set. Now used by several manufacturers as standard equipment. Made of one piece porcelain; no metal shell, hence no ground hum. Better for power tube work, as it withstands heat and will not melt. Patent pending.

Every progressive dealer now handles the CROSLEY V.T. SOCKET or will obtain them for you. If your dealer can't supply you, send us his name and order direct. We will ship prepaid. Every socket is GUARANTEED to give satisfaction or money refunded.

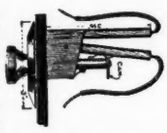
The Crosley Variable Condenser

(Pat. Pend.)

"BETTER—COSTS LESS"



This Condenser works on an entirely new principle. The two plates are hinged and are opened and closed like a book by means of a specially designed cam. The plates are surfaced with copper. One copper sheet is covered with mica, so that when the two plates are clamped tightly together the maximum capacity is obtained. The maximum capacity of this Condenser will average about .0008. We rate it conservatively, however, at .0005.

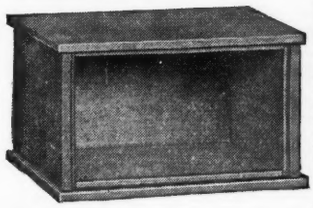


This Condenser has several advantages over the ordinary type of air condenser. Will stand 1000 volts without breaking down. It can therefore be used for C.W. work. Has no body or hand capacity effect. Has much greater signal strength due to the fact that mica is a much more efficient dielectric than air. The calibration curve of this Condenser is almost a straight line. Has unusually low zero capacity—.00006.

Price without knob and dial.....$1.25
With knob and dial..... 1.75
Mounted in cabinet with knob and dial..... 2.50
Knob and dial only for 3/16" shaft..... .50

Sold on a GUARANTEE of absolute satisfaction or money refunded.

Crosley Cabinets



The tendency in the radio field today is to put apparatus in cabinets not only for appearance's sake, but as a protection from dust, dirt, atmospheric conditions, etc. Realizing the demand for attractive stock cabinets of various sizes, we are building them in quantities in our large wood working plant. These cabinets are all uniform in style. The panels are rabbated in to the front. As the outside dimensions and inside dimensions are either larger or smaller than the panel itself, we show panel size and also inside dimensions. Prices quoted do not include the panels.

Wood used is either gum or mahogany in dark antique or red mahogany finish or in quartered oak in natural or antique finish. Specify type of wood and finish in ordering. Lids or tops are hinged. Sizes and prices are:

CABINETS

For Panel Size	Inside Dimensions High	Wide	Deep	Mahogany or Quartered Gum	Oak
6 x 7	5⅛"	6⅛"	7"	$2.50	$3.85
6 x 10½	5⅛"	10"	7"	2.75	4.40
6 x 14	5⅛"	13⅛"	7"	3.30	5.55
6 x 21	5⅛"	20⅛"	7"	3.90	7.30
9 x 14	8⅛"	13⅛"	10"	3.70	6.80
12 x 14	11⅛"	13⅛"	10"	4.40	6.80
12 x 21	11⅛"	20⅛"	10"	5.25	10.60

Cash must accompany order. No C.O.D.'s. We pay transportation charges

FORMICA PANELS

We can furnish genuine formica panels 3/16" thick, cut to the following dimensions: 6 x 7; 6 x 10½; 7 x 9; 6 x 14; 7 x 12; 6 x 21; 7 x 18; 9 x 14; 12 x 14; 14 x 18; 18 x 21. Price of panels—2½c per square inch. For odd sizes order the next largest size: we will trim. We pay postage.

HARKO RADIO RECEIVER

The most compact and complete efficient crystal receiving outfit on the market. Designed for the amateur who wishes to get started in this wonderful game. The illustration shows complete outfit ready to hook to aerial, fones and ground wire.

Will tune from 200 to 600 meters, bringing in spark, voice and music with average amateur antenna. NAM, Norfolk, Va. and ships at sea copied in Cincinnati.

20 Watt Radiophone copied 25 miles with addition of the Crosley Variable Condenser in series with antenna. Radiophones copied five to ten miles without condenser.

A wonderful little instrument. Price complete with battery, interrupter for testing crystal, instructions, etc., $9.00. One thousand ohm single head set, 125 ft. antenna wire, insulators, etc., $6.00 extra. Complete outfit, $15.00

If your dealer cannot furnish, we will ship direct prepaid.

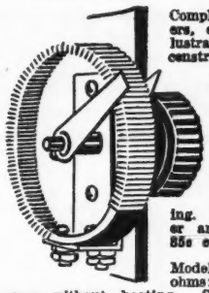
CROSLEY BINDING POSTS

Barrel ¾" x 1½". Not too small nor too large. just the right size.

Nickel plated. Complete with base screw and washer as illustrated.

Price, 8c each or 90c per dozen.

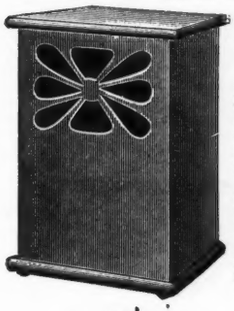
CROSLEY RHEOSTATS



Complete with knob, pointers, etc., as shown in illustration. Our unique construction permits mounting on panel of any thickness up to and including ¾"; non-corrosive resistance wire.

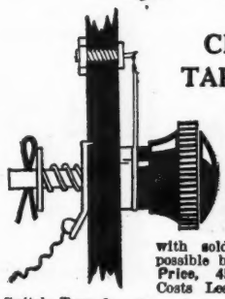
Model "A"—overall diameter 1⅝". Resistance 7 ohms, one ampere without heating. Suitable for detector or amplifier tubes. Price 85c each.

Model "B" Resistance 4 ohms: will carry 3 amperes without heating. Suitable for detector, where very accurate adjustment is required and for 5 watt power tubes. Price $1.50.



CROSLEY MAGFON

No radio station complete without it. Built in horn; amplifies signals, voice, or music, making head phones unnecessary except on weak signals. Uses one watch case receiver, any make; simply insert it in back of cabinet. Beautiful antique mahogany finish. Price, $10.00.



CROSLEY TAP SWITCH

Note unique construction assuring constant tension. Composition knob, nickel plated switch arm and bushing. Note stationary washer with soldering lug, making possible buss wire connection. Price, 45c each. Better—Costs Less.

Switch Taps for above, brass nickel plated, complete with brass nut, 3c each, 30c per dozen or $2.50 per hundred.

Every article bearing the name "CROSLEY" is GUARANTEED to give absolute satisfaction or money will be refunded.

We shall be pleased to send literature describing the above mentioned and other radio apparatus to any one free of charge upon request. Get your name on our mailing list to receive latest Bulletins of other new Crosley products. If your dealer does not handle our goods, order direct and send us his name.

DEALERS—It will pay you to handle our lines. Write for full particulars.

CROSLEY MANUFACTURING CO.
Radio Dept. No R-6 CINCINNATI, OHIO

ANNOUNCEMENT

The New DEFOREST Catalogue

is now ready and includes cabinet receiving sets, panel sets, C. W. transmitters, radiophones and parts, for amateur use. Sent upon request and receipt of 12c in stamps.

DEFOREST WIRELESS TELEPHONE AND TELEGRAPH SYSTEM APPARATUS

ANNOUNCEMENT

The New DEFOREST Receiving Sets

will be described and illustrated in this magazine next month. Do not buy until you see FEBRUARY ISSUE

DEFOREST RADIO TEL. & TEL. CO.
New York City

Everything—

The new branches—arcs and tubes—of the revised examination of the Department of Commerce are fully covered in the Home Study Course of the Radio Institute of America.

Enrollments are coming in by every mail. Why aren't you one of the wide-awake wireless men who have seen the new and greater opportunity opened to them by the Home Study Course, which is specially designed to land them one of the enviable jobs at the world's greatest radio station?

It will be equipped to work simultaneously with five other nations in widely separated and distant parts of the world.

A position at this station is the height of every operator's ambition, for it means unlimited opportunity to succeed and progress to higher, more responsible and better paying positions in the radio industry. So far as opportunity goes the successful future of these men is assured.

How about you?

The graduates of the Radio Institute of America enjoy a great and exclusive advantage in the close connection existing between the Institute and the Radio Corporation of America, the world's largest radio manufacturing and commercial radio company.

Prominent executives in the radio field are former students of the Institute. The Radio Corporation employs thousands of men, in its executive departments, on ships and at shore stations and in factories and laboratories. A large percentage of these men are graduates of the Institute.

The Radio Institute of America has been an established and successful institution for over fifteen years. It has trained over 6,000 men, 95% of whom have successfully engaged in this new branch of science and industry.

Write for our booklet and further details—*Now.*

HOME STUDY DIVISION

Radio Institute *of* America

(formerly Marconi Institute)

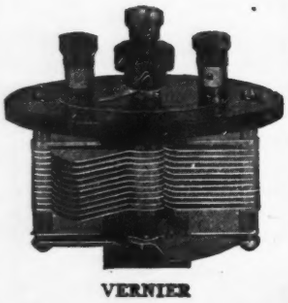
324 Broadway, New York

"ILLINOIS" THE RELIABLE

MADE RIGHT - STAYS RIGHT

STYLE No. 1

STYLE No. 2



VERNIER

Three Styles: No. 1, Panel; No. 2, Open Type as shown; No. 3, Fully Encased. Anti Profiteer. Less than pre-war prices. Fully assembled and tested.

	Style No. 1	No. 2	No. 3
67 Plates,	$7.00	$8.00	$8.50
43 "	3.50	4.50	4.75
23 "	2.75	3.75	4.00
13 "	2.25	3.25	3.50

Money back if not satisfied. Just return condenser within 10 days by insured Parcel Post.

Options:—With Style No. 1—instead of Scale and Pointer, a 3-inch Metal Dial at 50 cents extra, or a 3-inch Bakelite Dial at $1.00 extra. Large Knobs Both excellent values. Or we will, if desired, supply the Condenser with smooth 3-16 inch center staff, without Scale, Knob and Pointer, at 15 cents off the list to those who prefer to supply their own dial.

Vernier with single movable plate applied to 13, 23 or 43 plate condenser, $3.00 extra.

We allow no discounts except 5 percent on orders of 6 or more.

Sent Prepaid on Receipt of Price

Except: Pacific States, Alaska, Hawaii, Philippines and Canal Zone, add 10c. Canada add 25c.

Foreign Orders other than Canada not solicited.

G.F. JOHNSON, 625 Black Ave., Springfield, Illinois.

which are forced in the wells at the top after the plates and separators have been put in place.

Small rubber friction tips or buttons such as are used for attaching to chair legs, etc., can be used to cap the finished cells when the latter have been fully charged, or the top of each cell can be filled with a light cylinder oil instead to keep to acid from spraying out and evaporating when charging and standing. Before capping, the top of the whole unit should be well dried with a small cloth or brush to prevent any possible leakage of current.

The views which accompany this story have been made as clear as possible, and the description as much in detail as space will permit, but the author is always willing to answer any question which may come up in the mind of anyone undertaking to make a battery of the type just described.

Blazing the Amateur Radio Trail

(*Continued from page* 604)

To be sure, this amateur's transmitter came in like a ton of bricks anywhere in the city, for I had had occasion to hear him on other amateur receiving sets. So I set out for his home.

To my mind, here is one of the most remarkable stories of early radio days. This amateur was a doctor who, so the story goes, had a pet grudge against a large wireless company then operating. Perhaps he had purchased much more or less worthless stock from that concern now long since defunct; perhaps it was a more personal reason: but the point is that he had one of those grudges that stop at nothing to attain their end. His whole aim in life, just then, was to embarrass that wireless company in every possible way, which was not a difficult matter considering the absolute absence of radio laws, crude tuning circuits, and the proximity of one of that company's crack stations.

At any rate, the doctor had got together two huge X-ray transformers, a whole box full of home-made condensers soaked in oil, a huge spark gap which had to be muffled to cut down the noise, and a large ten-wire aerial. The doctor was located on the ground floor of an apartment house, and his lead-in came all the way down from the roof six stories above the transmitter. Every time the key was pressed, the lead-in wire glowed with a purplish brush discharge at night; but what was the difference? Efficiency meant little or nothing, for the distance to be covered was less than 10 miles.

That station was the greatest nuisance that ever existed. When it was sending, it was impossible, or nearly so, to receive anything from any other station, because said station was operating on a very broad wave which came in all over the tuning coils then in general use for reception purposes.

Within a radius of 20 miles, that amateur station was simply formidable. It had a harsh, unpleasant spark that could be picked up on almost any adjustment of the tuner. It sounded for all the world like a Transatlantic station—at least when within a reasonable range. But the joke of the matter was that this station did not carry very far. I well remember trying to pick it up some 30 miles distant. I finally succeeded in getting it, but the signals were so weak that they could barely be identified. It was simply one of those instances of a big splash, so to speak, which did not get very far. For that matter, it was the same with some of the commercial stations of those early days. Take the old "DF" station—Manhat-

LEARN ELECTRICITY

The BOY'S ELECTRIC TOYS

As Shown

$7.50

Complete

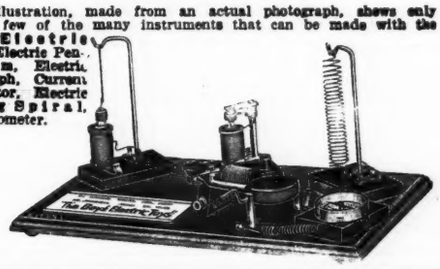
Teaches you all the principles of electricity by the "Learn by Doing" Method. Entertaining, Instructive, More Fascinating than any game. The most complete electrical experimenters' outfit that has ever been put on the market.

Valuable Electrical Instruction Book With Each Outfit

With each outfit we furnish free a very comprehensive book of electrical instruction. All the fundamentals of this fascinating science are clearly explained so even a layman can understand every word. Profusely illustrated. The instructions for building the apparatus are given in such a simple and easily grasped manner that anyone can make them without the least trouble. Over a hundred experiments that can be performed with the outfit are listed in the instruction book, nearly all of them illustrated with superb drawings.

A Sample of What You Can Do With This Outfit

This illustration, made from an actual photograph, shews only a very few of the many instruments that can be made with the **Boy's Electric Toys: Electric Pendulum, Electric Telegraph, Current Generator, Electric Dancing Spiral, Galvanometer.**



The outfit contains 114 separate pieces of material and 24 pieces of finished articles ready to use at once.

Among the finished material are included: Chromic salts, lamp socket, mercury, core wire, iron fillings, three spools of wire, carbons, machine screws, flexible cord, wood bases, glass plate, paraffine paper, binding posts, screw-driver, etc., etc.

Teaches You How To Build Electrical Apparatus

THE BOY'S ELECTRIC TOYS' contains enough material to make and complete over twenty-five different electrical apparatus without any other tools, except a screwdriver furnished with the outfit. The box contains the following complete instruments and apparatus which are already assembled:

Student's chromic plunge battery, compass-galvanometer, solenoid, telephone receiver, electric lamp. Enough various parts, wire, etc., are furnished to make the following apparatus:

Electromagnet, electric cannon, magnetic pictures, dancing spiral, electric hammer, galvanometer, voltmeter, hook for telephone receiver, condenser, sensitive microphone, short distance wireless telephone, test storage battery, shocking coil, complete telegraph set, electric riveting machine, electric buzzer, dancing fishes, singing telephone, mysterious dancing man, electric jumping jack, magnetic geometric figures, rheostat, erratic pendulum, electric butterfly, thermo electric motor, visual telegraph, etc., etc.

Shipment guaranteed within 24 hours.

SEND NO MONEY

We have so much confidence in this set that we desire to ship it to you C. O. D. with the privilege of inspection. It does not cost you one cent to take a good look at the outfit, and see if it comes up to your expectations. If it does, pay the postman $7.50, plus shipping charges. If it does not, you need not accept it, and we will pay the return charges as well.

THE ELECTRO IMPORTING CO.
231 Fulton St., N. Y. City

ELECTRO IMPORTING CO.,
231 Fulton St., N. Y.

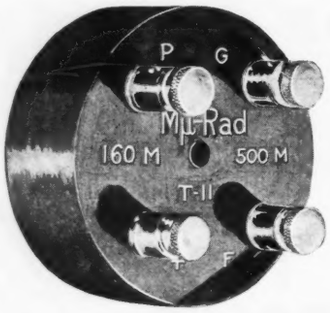
As per your advertisement, ship to me at once, C.O.D., the Boy's Electric Toys with privilege of inspection. It is understood that if I do not like the outfit I can refuse it.

Name .....

Address .....

City..... State.....

(RN 1-22)



R. F. AMPLIFICATION
at SHORT WAVELENGTHS

RECEIVER SENSITIVITY: Increased receiver sensitiveness can only be had by amplification of r.f. signal voltages before they reach the detector. This can be accomplished by conventional r.f. amplifier circuits or by regeneration, or by a combination of both.

DESIGN: MU-RAD R.F. AMPLIFIER TRANSFORMERS have been built upon two principles not hitherto utilized in such equipment, and combine regeneration and straight r.f. amplification uniquely in a single unit to give exceptional amplification. Our standard type T-11 transformer is built especially for amateur wave-lengths where effective amplification is so difficult on account of tube and socket capacities.

TUBES: MU-RAD T-11 TRANSFORMERS must be used with Moorhead A-P amplifier tubes. The inter-electrode capacities and impedance of these tubes are especially suitable for short wave amplification and are utilized in our transformer and circuit design.

SOCKETS: Any of the standard tube sockets having diagonally mounted contact springs may be used, as the socket capacities in the various types do not vary sufficiently to affect the transformer operation.

OPERATION: Do not test these amplifiers on strong signals, but observe that stations absolutely inaudible with a detector and audio-frequency amplification (however great), come in loud and clear with a stage or two of MU-RAD amplification.

GUARANTEE: MU-RAD TRANSFORMERS, properly used, are guaranteed to give greater amplification than any other on the market. Purchase price refunded if users tests do not verify this claim.

Radio-frequency Amplifier Transformer, 150-500 m. with connection diagrams and instructions, price $6

NO PLATE CIRCUIT TUNING ADJUSTMENTS
NO HOWLING—EQUALLY EFFECTIVE ON C.W., PHONE, SPARK

DEALERS: STOCK NOW—BIG DEMAND

MU-RAD LABORATORIES BOX 341 ASBURY PARK. N. J.
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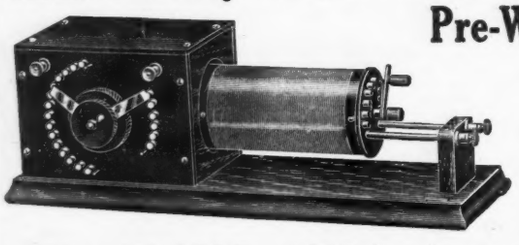
Arnold Navy Model Loose Coupler Back to Pre-War Price, $15.00



The most consistent piece of Radio apparatus to hear the Radio telephone "Without distortion."

Range from 200 to 3,000 meters. Send 3c stamp for literature describing Arnold made "Audion Detectors, Amplifiers, Short Wave and Arc Sets.

SPECIAL

Any make of Radio set repaired—rewired—rebuilt. Your pet idea built to order "reasonable."

J. F. ARNOLD, 2082 Lexington Ave., NEW YORK

ESTABLISHED 1910 TEL. CONNECTION

tan Beach—a dinky collection of radio odds and ends thrown together and attached to an aerial located in the swamps back of Coney Island, near the sea. Nearby, that station had a rather low tone, none too loud. But that old station carried! Night after night it carried way down to the Gulf, where fruit steamers were cruising. In fact, it made many of the early radio records. On the other hand, there was a model station known as "WA," located on the roof of the Waldorf-Astoria Hotel in the very heart of New York City. Nothing in the way of expense had been spared in making that station the very last word in radio; indeed, it was a demonstration station where visitors were introduced to the marvels of wireless and the commercial possibilities of radio. Nearby, that "WA" station came in with a roar. Even with our crude receiving sets then available, we could lay the telephones on a table and hear the signals five feet away. But if we got 100 miles away, then "DF" came in about as loud as when heard some few miles away, while "WA" had lost its roar and was, if anything, far weaker than "DF." At several hundred miles distant, "WA" was lost altogether, while "DF" continued to be heard. So this business of loudness in those early days was quite deceptive, as we soon found out.

Pardon me for the digression. I must get back to the doctor with the grudge. The doctor had a practice which he had to attend to, and his calls took him out of his office not a little. But so that no time might be lost, he invited the amateurs from far and wide to visit his station and keep the transmitter busy during his absence. How about having nothing to send? How about having nobody to talk to? Little matter; the doctor suggested that we simply take a newspaper, magazine or any other "copy" and send sentence after sentence, hour after hour! I never saw the electric light bills, but rumor has it that the monthly bills ran up to $60, and over. I believe it. The doctor was pulling something like 10 kilowatts out of his meter hour after hour. Needless to say, he embarrassed the wireless company greatly; in fact, he made its life almost unbearable about New York. I don't know what was the final outcome of this story. Perhaps the doctor received a just settlement for his efforts, perhaps not. If this were fiction, I could certainly supply a "happy ending" by saying that he finally got his stock certificates cashed for their face value, with compound interest to boot!

The doctor was not the only one who tormented the commercial and Government stations. The chatter passing through the ether was simply dreadful. Everybody was talking at once, and it seemed that perhaps no one was listening in. Every once in a while some commercial operator, with a thunderous spark, which should have commanded a certain degree of respect, would break in, saying: "Go to bed! Haven't you had enough for one evening?" and other phrases with like import.

Little wonder that radio laws were finally passed. Mr. H. Gernsback, then editor of MODERN ELECTRICS, never missed an opportunity of calling attention to the abuse of our liberties, but even though the more conservative among us appreciated our radio freedom and did not want to jeopardize it in any way, there were certain amateurs who simply did not care.

All in all, we were not always a nuisance so far as the commercial and Government operators were concerned. For instance, the old Brooklyn Navy Yard station was located down in a hollow among the several steel bridges that span the East River. Wirelessly speaking, it was more or less screened. Many a time the Navy operator would not be able to copy a message being

SOMETHING NEW IN RADIO

MAKE YOUR OWN

Pattern No. 2 Just Out

50c. Per Set Prepaid

Send for Pattern No. 1 Complete Short Wave Regenerative Set and for Pattern No. 2

Both Together: $1.00 Prepaid

The second set of patterns that we are offering now to the amateurs and radio experimenters, was designed so as to match the short-wave regenerative set which may be built with patterns No. 1 designed especially for its construction. The panel of each unit is of the same height, and the disposition of the binding posts makes it possible to use the detector control cabinet alone, or with any number of amplifier units, with only one "A" and one "B" battery, if so desired. The arrangement of the binding posts was made with a view to avoiding any long wiring from the batteries to the filaments of the tube used in each unit, and each of these control cabinets, being fitted with a jack, the telephones may be plugged in for the detector alone or any number of stages of amplification connected to it.

The detector and amplifier units, which may be built from this set of patterns may be used with any type of regenerative receiver, or long wave set, using honeycomb coils or any other form of inductance for tuning. Only those who built the short wave regenerative set of this series of patterns, can appreciate the simplicity and ease of construction of these new instruments.

If, to the short wave set, which may be built with the set of patterns No. 1, are added a detector and two amplifying units, the receiving outfit thus composed will give wonderful results and will enable the owner to operate a loud talker for the entertainment of his friends with radiophone transmissions, which may now be received every day. The appearance of the complete receiving outfit, which may be built with these sets of patterns, is as attractive as that of any standard make of apparatus, and its functioning is as good and we may say, in several cases, better.

Patterns are printed on heavy blueprint paper exactly the size of the panels to be used.

The position of the holes and other markations are exact, so that all you have to do is to paste the pattern on top of your bakelite panel by means of ordinary library paste, and when dry drill right through the pattern wherever the marks are located.

This does away with all fussing and calculating as we have done all the laying out in our own shop, and you need not worry that the final instrument does not come out right.

BEFORE SELLING YOU THIS PATTERN WE HAVE GONE TO THE TROUBLE OF ACTUALLY BUILDING THE OUTFIT AND WE KNOW THAT IT IS ABSOLUTELY RIGHT IN ALL PARTICULARS.

The original may be inspected at any time. Only standard parts are used in making the outfit.

Complete and very explicit directions go with the pattern which is furnished in a heavy envelope 9 x 12".

Complete pattern for detector and amplifier units consisting of two full size blue-prints and four pages 9 x 12 instruction pamphlet in heavy envelope, per set prepaid,

50 c

Either Direct from us or for sale by the following responsible Dealers:

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Alamo Sales Corp., Indianapolis, Ind.
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Duck & Co., Wm. B. Toledo, O.
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Hico Wireless Sup. Co., Marion, Ill.
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Holt Electric Util. Co., Jacksonville, Fla.
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Liberty Radio Sup. Co., Chicago, Ill.
Linze Elec'l. Sup. Co., St. Louis, Mo.
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Manhattan Elec. Sup. Co., N. Y. & Chic.
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—For RADIO CITIZENS

PARADO COMBINATION OFFER NO. 1
FOR A COMPLETE RECEIVING SET.

2	Remler Variometers with dial	$14.00
1	Remler Variocoupler, with dial	6.40
1	Switch and 10 Contact Points (Nickel Plated)	1.00
2	Stops and 3 Indicators (Nickel Plate)	.25
1	Murdock No. 56 head set	5.00
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1	Murdock Rheostat	1.00
1	DeForest Socket	1.00
1	Panel 6 x 22 x ⅜	1.88
7	Nickel Plated Binding posts	.70
12	Feet connecting wire	.10
1	Diagram of panel drillings and hook-up of instruments	FREE
	Total	$33.03

Our Special Combination Price, $34.80

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Get our Special Combination Offers to Dealers and Agents on apparatus made by these well known companies:

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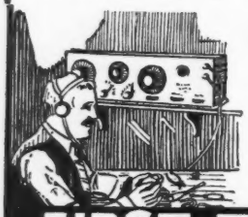
We represent the largest manufacturers of the best equipment made. If you are an agent or dealer, get our special discount lists and bulletins.



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FIRST TESTED — THEN SOLD

$5.00

ARKAY
Loud Speaker
RADIO HORN

Will amplify your signals, speech or broad casted music without distortion.

This horn is constructed to fit any make of receiver through the use of an adapter under the base.

Works on one or two stages of amplification.

Furnished in black enameled finish $5.00.

Order through your dealer or direct from us, remitting by money order the price of horns, plus parcel post to your address.

Shipping weight 4 lbs.

Distributed by
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DEALERS — Write for Proposition.

RILEY-KLOTZ MFG. CO.
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U. S. GOVERNMENT RADIO BLINKER SIGNAL SET

A model of perfection and all-around utility, officially adopted by the U. S. Army Air Service, U. S. Marine Corps and Navy Department Bureau of Steam Engineering. It is a self-contained unit, and may be operated on the table, in the lap, or in any position desired. Note detachable arm.

Special Price $6.00

Ask your dealer or write us.

Of high grade construction, designed for the purpose of instruction in audible or visual signals, with the International or other codes based on the dot and dash principle. It is scientifically made for efficiency, simplicity, compactness and durability.

Frank B. Perry & Sons
Newton Center, Mass.
Providence, R. I.

READ the CLASSIFIED ADVERTISEMENTS on PAGES 676-678 YOU'LL FIND MANY GOOD THINGS THERE

sent to him, and some thoughtful wireless amateur would break in to tell the Navy operator that he, the amateur, had the message. Then the Navy operator would call up the transmitting station, and tell him to stand by while he got the message from the nearby amateur. The same applied to the commercial operators, who on more than one occasion had to resort to some amateur operator located in a dingy apartment-house bedroom.

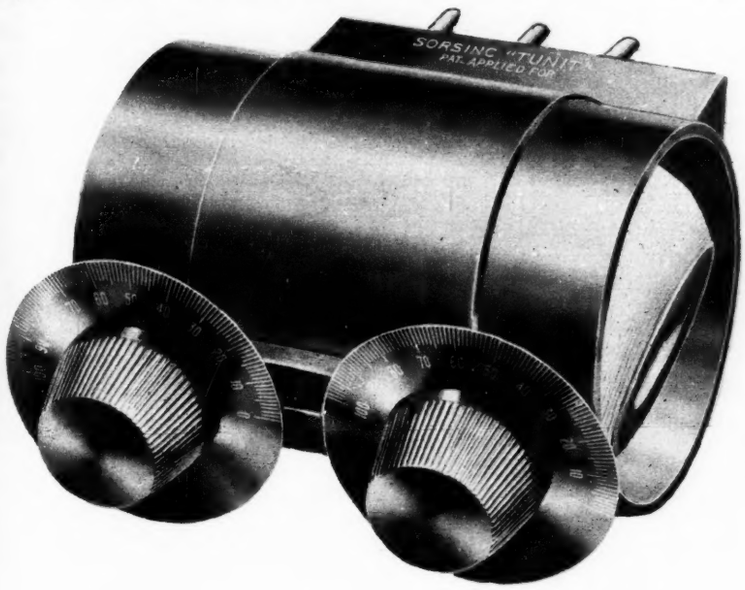
By 1909 we got around to the crystal detectors. Some of us used carborundum, but it was so difficult to get good pieces of this material that we generally used something else. Carborundum had at least one good feature, and that was the tightness with which it could be clamped in a detector stand, making it practically proof against mechanical disturbances. Silicon was a great favorite, and later came galena. For my part, I had read in a copy of *The Electrician* of London—that awfully deep but authentic British journal that has ever been the official organ for the foremost wireless workers—that the Germans were using galena with a fine graphite point. So I made detectors from tiny springs on which I soldered the galena, and hard leads for automatic pencils, pointed to a needle point. These detectors were remarkably sensitive. I was able to hear "DU," the station on the DuPont Hotel in Wilmington, in New York City on a two-wire aerial less than 15' long.

The radio telephone in those days was a laboratory experiment, little more or less than just that. One day, while listening in I happened to detect a hissing, steam-like noise on one part of my two-slide tuning coil. Upon finer adjustment the noise grew quite loud, drowning out everything else. Then I caught a few words, followed by music. But how crude! A few words, then a horrible break, a few more words, and another break, and so on. It was an experimenter some few miles away, using an arc to generate the high-frequency oscillations.

Another novel experience was when DeForest first introduced the quenched spark. It sounded like music, for his gap made all kinds of notes, whistling all the while. His station was then located in the Metropolitan Tower, and his apparatus, so I understand, was of the Lorenz design, made in Germany.

By 1910 we began to get into vacuum tubes. These were crude at first, but their sensitiveness over the crystal detectors was so marked that they soon became the most widely used detectors. With these developments came the present radio laws. From that time on progress became more rapid. Better tuning methods were introduced, the vacuum tube became more highly developed, the regenerative circuits were introduced, and with the advent of the war, far greater improvements took place.

The present status of amateur radio is almost unbelievable to one who, but a short 12 years ago, was experimenting in this same field. Indeed, if the development during the next dozen years is just as great, what remarkable things we can look forward to! I have in mind the evening entertainment in the average American home. There will be music, the news of the day, stock reports, baseball scores, and so on. In fact, that already exists to a limited extent. I also look forward to the reception of pictures of the day. Having followed Mr. Edouard Belin's work with great interest, especially his recent experiments in radio transmission of drawings between France and the United States, I have every reason to believe that in the future the amateur, not content with receiving audible signals, will turn to the reception of drawings, type matter, and even photographs. Why not? The ingenious Frenchman has devised a simple receiving apparatus which



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To Dealers: If you haven't stocked "TUNIT" yet, it will pay you to wire at once for information. Good profits await you in handling this quick selling, satisfaction-producing tuner.

for 160 to 600 meters, use

THE SORSINC TUNIT

THE SORSINC "TUNIT" when attached to your Honey comb coil set, duplicates the performance of the most expensive short wave sets, on 160 to 600 meters, at a price any amateur can afford. It consists of a stationary coil and two rotors. Pigtail spirals are used to give perfect electrical contacts. Equipped with black metal dials and molded knobs. In fact, every essential is provided in highest quality and workmanship to give you best value per dollar.

Use the Sorsinc "TUNIT" in your present standard triple coil mounting.

"TUNIT" is now on the market. Examine it at your dealers' or at any of the Sorsinc Branch Stores listed at the left.

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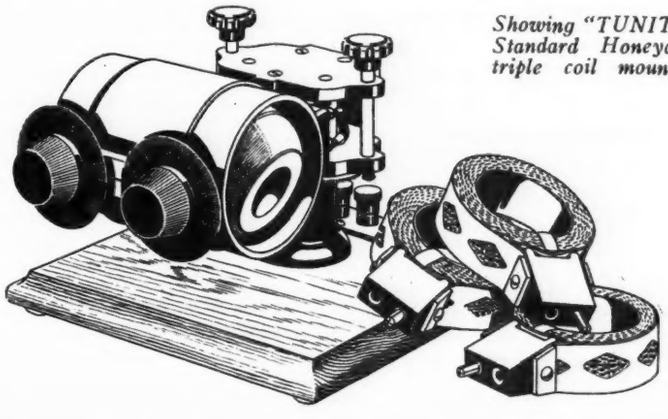

Showing "TUNIT" in Standard Honeycomb triple coil mounting.

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Your name and address on a postcard brings the new Sorsinc folder of latest apparatus at newest prices by return mail. Absolutely FREE. Send for it at once, before you buy any new instruments. Prompt mail order service from every branch.

Throughout the length and breadth of the land, thousands of families are listening to music, concerts, news of the day, lectures, weather reports, church services, etc., right in their own homes with a $15.00 "Marvel" Radio Telephone Receiving Outfit. No longer is it necessary to have expensive apparatus or any knowledge or experience in wireless telegraphy.

Bring YOUR Home in Touch With The Outside World

Get a "MARVEL" Radio Telephone Receiving Outfit. Music, concerts, lectures, current news, sermons, Government reports, etc., will come to you daily. The cost is small—only $15.00 complete! Nothing else is needed. Receives speech and music, etc., within a 50 mile radius of the large radio telephone broadcasting stations, and wireless telegraph messages within many hundreds of miles.

The "MARVEL" RADIO TELEPHONE RECEIVING OUTFIT, is the only COMPLETE crystal receiving outfit on the market with a wave-length range of 180 to 2,600 meters. The OUTFIT is thoroughly practical, dependable and complete. It can be quickly and easily set up for use. No source of power, no batteries, no license and no special knowledge is necessary for installation.

THE COMPLETE "MARVEL" RADIO TELEPHONE RECEIVING OUTFIT, Model 105, consists of a "MARVEL" Radio Receiver (a completely enclosed, highly efficient, crystal receiver, mounted in a handsomely finished mission oak cabinet), 150 feet of solid copper wire (for the antenna), 5 porcelain insulators, a 1,000 ohm telephone with leather covered headband and telephone cord, antenna switch, ground clamp, code chart, abbreviation chart, and COMPLETE instructions for installation and operation. Nothing else is needed..... **$15.00**

Model 110, same OUTFIT, but with a 2000 ohm double headset **$18.00**

Quality Apparatus **Designed by Engineers** **Popularly Priced**

"MARVEL" RADIO TELEPHONE RECEIVING OUTFITS are for sale at all progressive Radio and Electrical Dealers. If your dealer has not yet received his stock of "MARVEL" OUTFITS, we will send you one prepaid on receipt of Postal or Express Money Order, or via Parcels Post C. O. D. ORDER NOW—DON'T DELAY.

Look for the Registered Trade Mark on every genuine "MARVEL" RADIO TELEPHONE RECEIVING OUTFIT (Patents applied for).

Bulletin R-101 on request.

DEALERS: "MARVEL" RADIO TELEPHONE RECEIVING OUTFITS are nationally advertised; they are the most popular of crystal receiving OUTFITS. Get your share of the growing demand, by selling them. Liberal discounts and selling co-operation are part of our sales campaign. ORDER NOW!

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***OFFICES and SALES DEPARTMENT*: 170 Fifth Avenue, New York City**

Honolulu comes to Continental

From far-off Honolulu they send to Continental for prompt, accurate attention to mail orders.

This letter speaks for itself.

You who live much nearer

Honolulu,
Manila Islands, U.S.A.

Continental Radio & Elec. Corp.
6 Warren Street,
New York City

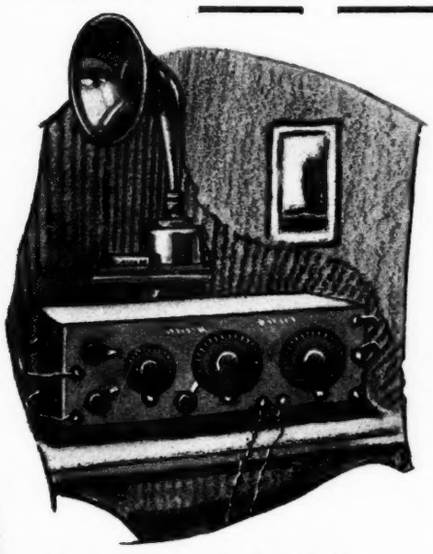
Gentlemen:

Today I am sending you a radio again for some wireless supplies. You are getting me delivery in fifteen days from the day I cable you, and that is some service to the center of the Pacific.

Yours very truly,
Cyril O. Smith

Permanent address, The Royal School, Honolulu U. S. A.

Have You Tried Continental Service?



Send for free leaflets describing Paragon R. A Ten, and the Creco Transformer.

Creco 112-page catalogue 25 cents.

THE Wireless Telephone broadcasting is bringing the wonders of wireless daily into thousands of homes that never dreamed of having a radio set before, as well as to advanced amateurs.

We are prepared to supply complete Wireless Telephone receiving outfits as low as $15.00! And of course we guarantee "Continental Service" to the purchaser to see that he gets perfect satisfaction.

Our comprehensive assortments include: The Marvel Set, $15.00 complete: the Aeriola Jr. $25.00: the DeForest Every-man Receiver $25.00: the Westinghouse R. A. set, $68.00; the Westinghouse R. C. set, $130.00; the Paragon R. A. 10 receiver—unexcelled for C. W. reception, $69.50; and the new Grebe CR9, $130.00. Orders by mail for any of these sets filled immediately.

CONTINENTAL
Radio & Electric Corp.

DEPT. C1

6 WARREN STREET NEW YORK

RADIO

With our complete and up-to-date stock, you are assured of having your order filled the same day it is received by us. You are overlooking a good thing if you don't take advantage of our prompt mail order service. Here are a few suggestions:

"Magnavox R 3 Radio Telemegafone—the loud speaker that makes the home radio concert a success. No station complete without a loud speaker and here it is for **$45.00**

"Yale" 6 T. 60 Storage Batteries, 6 volt, 60 ampere hour rating. Best for filament lighting. **$18.00.** Also Radisco "B" Batteries at standard prices.

"Radotron" Vacuum Tubes.

UV 200 Detector-Amplifier (soft)	$5.00
UV 201 Detector-Amplifier (hard)	6.50
UV 202 5 watt Transmitting Tube	8.00
UV 203 50 watt Transmitting Tube	30.00

Murdock No. 56 Receivers. The New Murdock Receiver's construction is characterized by its firmness, strength and durability. Complete double set, 2,000 ohms, **$5.00.** Complete double set, 3,000 ohms, **$6.00.**

"Aeriola, Jr.," Crystal Receiver. An ideal receiver for the beginner in radio. Complete with tuner, crystal detector and double head set in special cabinet with hinged cover. Ready to connect directly to antenna and ground. Tuning average up to 500 meters. Receives Radiophone music. Price **$25.00.** With Antenna Equipment, **$32.50.**

Vacuum Tube Receiving Outfit No. 1
Incorporating the Westinghouse R. A. Tuner

Westinghouse R. A. Tuner	$68.00
Paragon Detector Unit	6.00
1 "Radiotron" U.V. 200 Detector Tube	5.00
1 Murdock No. 56 2,000 ohm Headset	5.00
1 Eveready "B" Battery	3.00
Storage Battery not included	$87.00

Distant radio telephone, amateur and ship stations may be received at any wave-length within its range of 170 to 800 meters.

The addition of the loading coil allows the reception of signals on 1,600 to 2,800 meters wave-length such as Arlington time.

Vacuum Tube Receiving Outfit No. 2
Incorporating the Westinghouse R.C. Tuner

Westinghouse R. C. Receiver	$130.00
3 Radiotron UV-201 Vacuum Tubes	19.50
Type C.B. Loading Coil	5.00
2 Cell "B" Battery, Eveready	6.00
1 W. E. Signal Corps Headset	15.00
1 Pacent Plug Adapter	2.00
Storage Battery not included	$177.50

Type R. A. Short-Wave Tuner, style 307,189, responds to a wave length of 180 to 700 meters and is especially selective. Type D.A. detector-amplifier, 307,190, combines a vacuum tube detector with a two-stage amplifier. Type R.C. combines type R.A. in one cabinet. Both units are mounted on Micarta panels attached to a polished mahogany cabinet. Simple in design, easy to operate, single tuning circuit; highly efficient.

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Atlantic Radio service extends not only to experienced amateurs but also to those just becoming interested in wireless telephone broadcasting. At both of our two stores, our salesmen are experienced wireless operators who understand the complete stock that they are selling and are anxious to help you get the best results from your investment in radio. If you cannot visit our stores remember our mail order department is noted for its prompt and accurate service to all parts of the United States, Canada and scores of foreign countries.

When your friends newly interested in the wireless telephone ask you for advice tell them about Atlantic Service. Bulletin 14 and special broadcasting literature sent on request to the readers of Radio News and their friends.

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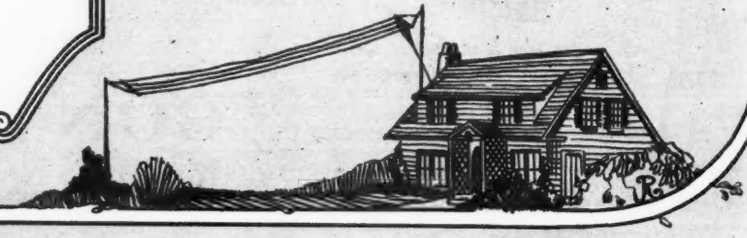

RADIO CORPORATION PRODUCTS

We are distributors and jobbers for the Radio Corporation of America and always carry a complete stock of their apparatus. We list below their complete line and in addition can supply you with the Radio Corporation C.W. instruction book at 25c per copy.

Item		List Price
	VACUUM TUBES	
1	Radiotron (detector) UV—200	$5.00
2	Radiotron (amplifier) UV—201	6.50
3	Radiotron (5-watt) UV—202	8.00
4	Radiotron (50-watt) UV—203	30.00
5	Radiotron (250-watt) UV—204	110.00
	POWER TRANSFORMERS FOR C.W. SETS	
12	325-watt, UP—1368	25.00
13	750-watt, UP—1016	38.50
	A—Filament heating Transformer for UV—204, UP—1633	.....
	B—Power Transformer for UV—204, UP—1636	.....
	C.W. ACCESSORIES	
14	Oscillation Transformer UL—1008	$1.00
15	Magnetic Modulator (½ to 1½ amp.) UT—1643	9.50
16	Magnetic Modulator (1½ to 3½ amp.) UT—1357	12.00
17	Magnetic Modulator (3½ to 5 amp.) UT—1367	17.00
18	Filter Reactor (160 milliamp) UP—1626	11.50
19	Filter Reactor (300 milliamp) UP—1627	15.75
20	Plate Circuit Reactor, UP—415	5.75
21	Filter Condenser ½ mfd.—750 V., UC—1631	1.35
22	Filter Condenser, 1 mfd.—750 V., UC—1632	1.85
23	Filter Condenser, ½ mfd.—1750 V., UC—1634	1.50
24	Filter Condenser 1 mfd.—1750 V., UC—1635	2.00
25	Transmitter Grid Leak (5-watt tubes), 5000 ohms, UP—1719	1.10
26	Transmitter Grid Leak (50 and 250-watt tubes), 5000 ohms, UP—1718	1.65
27	Antenna Ammeter, 0-2.5 amp., UM—530	6.00
28	Antenna Ammeter, 0-5 amp., UM—533	6.25
29	Sending Key UQ—809	3.00
30	Microphone Transformer UP—414	7.25
31	Filament Rheostat (for UV—200, 201 and 202) PR—535	3.00
32	Filament Rheostat (for UV—203 and 204) PT—537	10.00
33	Rotary Grid Chopper PX—1638	7.25
34	Shaft Bushings for ¼" or 5/16" motor shaft	.20

Item		List Price
	KENOTRON RECTIFIERS	
6	20-watt Kenotron, UV—216	7.50
7	150-watt Kenotron, UV—217	26.50
	VACUUM TUBE SOCKETS	
8	Porcelain Socket (for UV—200, 201, 202, 216) UR—542	1.00
9	Porcelain Socket (for UV—203 and UV—217) UT—541	2.50
10	Bakelite Socket (for UV—200, 201, 202, 216) UP—552	1.50
11	Mountings (250-watt tube) UT—501, UT—502	2.00
	SPECIAL CONDENSERS FOR C.W. SETS	
35	Antenna Series Condenser, 7500 V. .0003, .0004, .0005 mfd., UC—1015	5.40
36	Plate and Grid Condenser—3000 V. .002 mfd., UC—1014	2.00
37	Special Condenser—10,000 V. .000025 mfd., UC—1803	5.00
38	Special Condenser—.002 mfd., 6000 V., UC—1806	7.00
	VACUUM TUBE DETECTOR ACCESSORIES	
39	Intervalve Amplifying Transformer, UV—712	7.00
40	Special "A" Battery Potentiometer, PR—536	2.00
41	Tubular Grid and Plate Condenser	
	.00025 mfd. UC—567	1.20
	.0005 " UC—568	1.35
	.001 " UC—569	1.50
	.0025 " UC—570	2.00
42	Grid Leaks	
	UP—509, .05 megohm	UP—518, .75 megohm
	UP—510, .1 "	UP—519, 1.0 "
	UP—511, .15 "	UP—520, 1.25 "
	UP—512, .20 "	UP—521, 1.5 "
	UP—513, .25 "	UP—522, 1.75 "
	UP—514, .30 "	UP—523, 2.00 "
	UP—515, .40 "	UP—524, 2.50 "
	UP—516, .50 "	UP—525, 3.00 "
	UP—517, .60 "	UP—526, 4.00 "
	UP—527, 5.00 "	$ .75 ea.
43	Grid Leak Mounting UX—543	.50

CUT PRICES ON OVER-STOCK OF OTHER EQUIPMENT

	List Price	Our Price
Acme F-1 fully-mounted 1 K.W. transformer with choke coil	$45.00	$35.00
Acme H-1 fully-mounted ½ K.W. transformer with choke coil	30.00	22.50
Acme 500 fully-mounted ½ K.W. transformer without choke coil	22.00	17.50
Acme 250 unmounted ¼ K.W. transformer without choke coil	13.00	10.00
Mesco 1 K.W. keys with ¼ inch silver contacts	4.00	2.75
Tuska C.W. inductance Type 181A	5.00	4.00
L-104 Regenerative receiving transformer (loose-coupler)	29.50	20.65
L-103 Regenerative receiving transformer (loose-coupler)	23.50	16.45
L-102 "Standard" receiving transformer (loose-coupler)	19.50	13.65
121 Single capacity fixed phone condenser .005 M.F.	1.50	.80
122 Double capacity fixed phone condenser .005 M.F.	1.80	1.00
123 Double capacity fixed phone condenser .005 M.F. with switch	2.50	1.40
De Forest CV-500 condensers—ideal for C.W. work; .0005 M.F.	5.25	4.50
No. 115 Crystal detector complete with galena and cats-whisker	1.60	1.00
No. 117 Crystal detector complete with galena or silicon	2.15	1.50
No. 110 Crystal detector complete with galena or silicon	2.10	1.45

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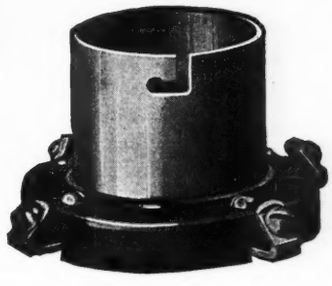

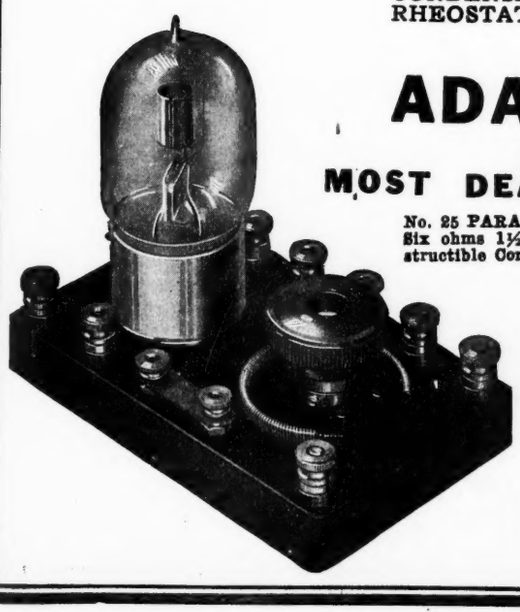

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No. 70 VT CONTROL $6.00.
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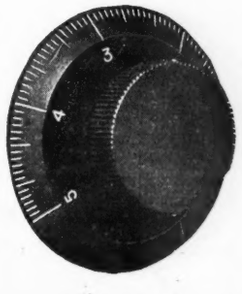

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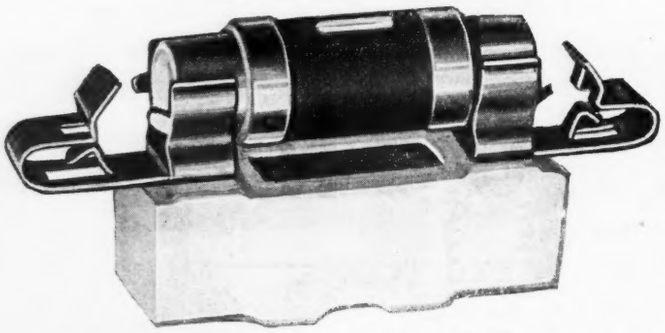

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in time may be reduced to the amateur's needs, and then, when connected with the regular amplifier circuit, it will reproduce anything which may be broadcasted from a Belin transmitter.

Then, too, the radio telephone must develop rapidly. I predict simpler and cheaper transmitters. They must come, for there is a vast demand for simple transmitters within the reach of all. Vacuum tubes must become a common commodity, just as electric lamps are today.

Junior Radio Course

(*Continued from page 606*)

sent on a 700 meter wave-length, the receiver No. 1 responding to the signal operates the relay R1, closing the circuit of the battery B1, the current of which flows in the winding the length of the dot. This flow of current magnetizes the core, which consequently attracts the piece of iron which is just below it at the time, as shown in dotted lines; this upward motion being effectuated while the arm attracted moves horizontally, makes the iron armature slide up on the rail, as in position B, Figs. 1 and 2. If, instead of a dot, a dash of a certain length is sent, the core of the magnet M being magnetized during the length of the dash, attracts several armatures in succession, which, one after the other, slides up on the rail, as explained before. Supposing the signal, dot dot dash, is sent at the proper speed, one armature will be attracted above the rail, then another one during the second dot, and three in succession during the length of the dash and their positions will be as shown in Fig. 3. When these armatures pass under the sets of brushes, which are all connected in series, this closes the circuit of the relay R2, attracting its armature to which is affixed a switch similar to those used in lamp sockets and operated by a little chain, which closes the circuit when pulled the first time and opens it when pulled the second time.

As may be seen, the circuit of the relay R2 can only be closed when the armatures, in the order described, close the circuit by short circuiting the sets of brushes connected in series. If a signal sent on 700 meters should accidentally operate the receiving set No. 1, one or more of the armatures could be attracted, but would not close the circuit if not in the proper order. When the armatures have revolved once, they fall down to their normal positions by sliding from the rail on the inclined plane and through the gap in the rail.

When the circuit of the relay R3 of the radio control system is closed by the switch C2, the radio control system may be operated on the 900-meter wave, as explained in the previous lesson, the circuit being again opened by that same switch, when the desired control is accomplished, locking, so to speak, the radio control apparatus. To accomplish this, the same operation as before is repeated, that is, the special signal sent on 700 meters and operating the "radio lock," is transmitted, energizing the relay R2, which opens the switch C2, cutting the circuit of the radio control device and preventing any signal sent on 900 meters from accidentally operating it.

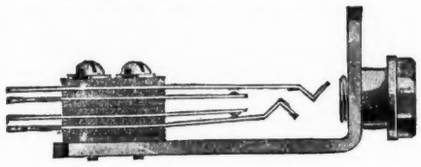
Some other system of "radio lock" may be used, designed differently and fitted with some improvements. If the reader is interested in the details of such instruments, we refer him to standard works on the subject, as the purpose of this course is to give but a general and simple description of the radio apparatus and their applications.

In the next lesson will be described some methods of photograph and picture transmissions.

THE PLEASURE OF USING PROPERLY MADE JACKS

NOW STANDARD WITH THE U. S. NAVY

It is indeed a real pleasure to use things that are "just right". Pacent Radio Jacks were designed for use in connection with radio apparatus. They are not improvised telephone jacks. They are available for a number of purposes in receiving equipment and in low power C.W. transmitting apparatus. Their use insures perfect contact with easy insertion and extraction of the plug. The construction of Pacent Jacks allows them to be built into radio euipment with minimum trouble. While doing your radio shopping the next time, ask to see these well-known Pacent Products.



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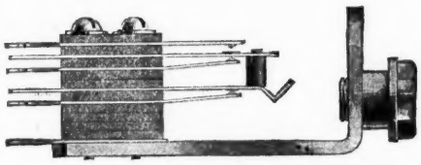
Commercial companies are using this jack as standard equipment and wise amateurs are recognizing its virtues. It costs no more than other jacks and it is better. Supplied in three styles; Open, Closed and Two-Circuit.

Prices range from $.70 to $1.00 each.



THE AUTOMATIC TYPE

This jack allows automatic filament control. Insertion of the plug lights the filament, while extraction breaks the circuit. Neat, rugged and built for a long life of good service. Why not avoid the disappointments of inferior makes? Three and five-spring styles.

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Wave Length Meters	Approximate Frequency Cycles per second	Phase Difference Degrees	Dielectric Constant-K
373	804,000	2.0	4.7
1,295	231,500	1.8	4.8
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READY FOR CHRISTMAS

We are pleased to announce that our new short-wave coils are ready for distribution. They are not "freak" coils but designed upon the solid fundamentals of radio practice. They are, however, adapted for use with our standard unit mounting fixtures. With a given condenser these coils all have a greater wave-length range, than the honeycomb coils.

But most important—note the H.F. resistance values and decrement of three of the secondary coils compared with three old type honeycombs.

	External Capacity	Wave-Length	H.F. Resist.	Power Factor	Decrement
Old Type 25....	.0001mf.	147	64	.0820	.257
	.0004mf.	244	11	.0340	.107
New Type 1s....	.0001mf.	147	12	.0154	.048
	.0004mf.	273	3	.0083	.026
Old Type 50....	.0001mf.	283	134	.0891	.280
	.0004mf.	475	23	.0364	.114
New Type 2s....	.0001mf.	305	26	.0160	.050
	.0004mf.	588	8	.0102	.032
Old Type 100...	.0001mf.	540	314	.1091	.343
	.0004mf.	900	40	.0334	.105
New Type 3s....	.0001mf.	623	71	.0212	.067
	.0004mf.	1160	11	.0072	.022

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The above cut shows part of the cover cut away which illustrates the convenience in inserting a new cell should one prove defective. These replacements are furnished complete with a positive and negative terminal soldered fast, and will be sent to any address upon receipt of 25c. They can be inserted without the use of soldering iron if desired.

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THE KEHLER RADIO LABORATORIES, Dept. R, ABILENE, KANSAS

A Simple and Efficient Adjustable Condenser

(*Continued from page 600*)

screw, until the blade bears on the switch points with sufficient force.

The condenser unit consists of 14 pieces of tinfoil 2" x 3", separated by thin waxed paper, 2½" x 3½". Seven of these are connected at one end to one of the binding posts, the other binding post being connected to the center of the switch. The other seven tinfoil sheets are connected to the seven switch points. This condenser block is sealed into the bottom of the case with paraffine wax.

This condenser may be used as a series or parallel condenser in the primary circuit, by means of a D.P.D.T. switch, by connecting up as shown in diagram.

The Construction of Lattice Wound Variometers

(*Continued from page 600*)

one may conveniently use 6-penny finishing nails.

The wire used for winding the coils may be from No. 18 to No. 24 B. & S. gauge and of either double or single cotton or silk insulation. The use of enamelled wire is not advised. For the best winding the writer has found that No. 22 single cotton, to be preferred. It will be found that cotton insulated wire will take shellac much better than the silk and that it stands up under the baking should the temperature run high, far better than the wire that is silk wound. Care should be taken to see that the wire is kept free of "kinks" in the winding.

For those unfamiliar with the winding of a lattice coil a short explanation of the process will be necessary. This explanation is applicable to either form.

In order to make clear the method of winding we will call one row of pegs of the form A, and the other B. The pegs of each row are numbered from 1 to 19, the number of any one peg in row A being the same as that of the peg exactly opposite it row B. Fig. 4 represents a winding chart for the form. It is as though the form had been "rolled out" on a sheet of paper beginning at peg 1 and on to peg 19 with pegs 1, 2, 3, and 4, repeated as 1', 2', 3' and 4', in the upper end of the chart. Thus beginning with your wire at peg 1 in row A, the wire is carried to peg 11 in row B and from there to peg 2 in row A, etc. Always bear in mind that the wire will, counting from any one peg in either row, pass around the tenth peg from that in the opposite row. Care should be taken to keep the windings as firm as possible, and to have an even tension on the wire at all times.

If you are using the flat form first described in this article, a piece of cardboard tubing, 3" in internal diameter and of sufficient width to fit between the two rows of pegs, may be inserted between the two rows of pegs before the pegs in one row have been inserted in their holes. This can not be done with the form for the spherical windings.

When the winding of the first coil, which will be the rotor of the variometer, is completed it should be varnished and baked, both processes will be described later, and after the baking a layer of felt followed by a layer of stiff paper should be wound over the first coil. The thickness of this "packing" should be about $\frac{1}{8}$" and it should be quite firm. Over this is then wound the second coil which will be the stator and when wound it too is varnished and baked.

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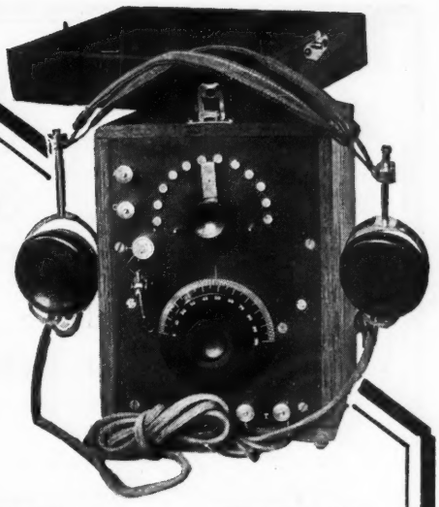

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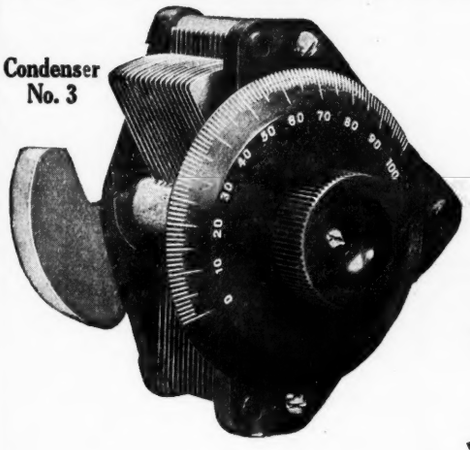
(Die-Cast Type)

Condenser No. 3

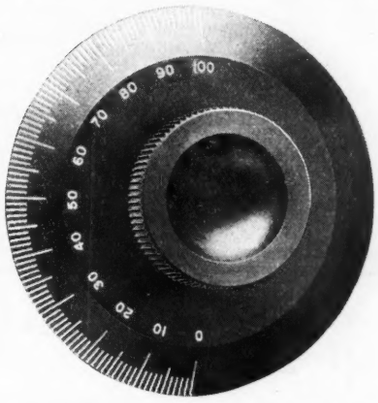


No. 1.—.0011 m. f. mounted	$5.00
No. 2.—.0006 m. f. mounted	4.50
No. 3.—.0011 m. f. unmounted	4.75
No. 3.—.0011 m. f. unmounted, without dial	4.25
No. 4.—.0006 m. f. unmounted	4.25
No. 4.—.0006 m. f. unmounted, without dial	3.85

Top, bottom and knob are genuine bakelite, shaft of steel running in bronze bearings, adjustable tension on movable plates, large bakelite dial reading in hundredths, high capacity, amply separated and accurately spaced plates.

Unmounted types will fit any panel and are equipped with counterweight.

Purchase from your dealer; if he does not carry it, send to us.



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The Chelsea dials are made of genuine bakelite, beautifully finished, and bear a 100 division semi-circular scale.

The dial is 3¼ inches in diameter, ¼ inch thick, with a long, sloping, easily read marking. Chelsea bakelite dials run true and will not warp.

The complete dial and knob is made to fit either 3/16, ¼ or 5/16 inch shaft. Specify size when ordering, otherwise the ¼ inch hole will be furnished.

Chelsea dials are beautiful in appearance low in price accurate and durable in service, unexcelled by any, at any price.

Dial and knob complete.....$1.00

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The Chelsea Amplifying Transformer is a supreme attainment in the design of Audio Frequency Transformers. It embodies the highest grade of materials obtainable and proper design, which reflects the result attained namely high amplification factor. It is unequalled either in electrical characteristics or good appearance.

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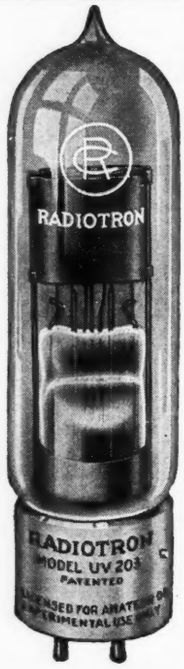
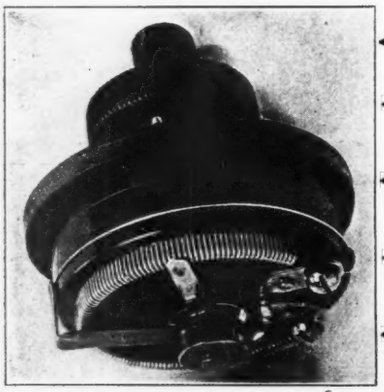


VERNIER RHEOSTAT



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1 Switch Lever, 1¾" Radius.
12 Switch Points complete with nut
2 Switch Stops complete with nut
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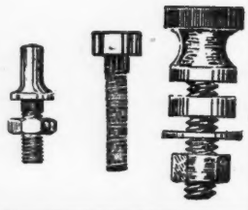

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A classified ad in Radio News will reach over 50,000 at a cost of only six cents a word.

The pegs are then removed from the holes with a pair of pliers, care being taken that the windings are not injured during the process.

The coils are varnished with shellac to keep the moisture from them and help them retain their shape. A small brush will be of aid in applying the shellac. When varnished they are baked for a period of several hours at a temperature of 250 to 300 degrees F. After baking the pegs are removed and the coils separated and tested to determine their equi-inductance by calculation as previously described or by the resonance method.

Each winding, if the coils are to be used in a short-wave regenerative tuner, should be of about 75 turns. The windings can be made as before mentioned to cover any desired range in wave-length that the constructor sees fit.

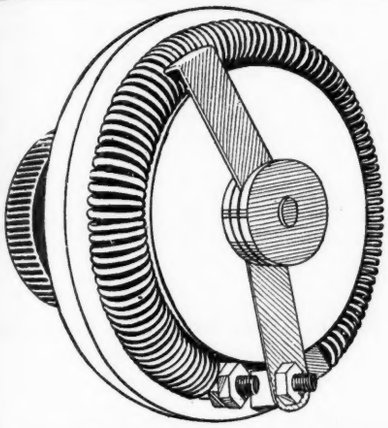
Having finished the rotor and stator coils the mounting of these two parts is to be considered. Nearly any method that is applicable can be used providing these two points are observed in its application.

The first is to keep a minimum of metals, especially iron, from the fields of the coils. The second point is to keep the resistance due to the connections between the rotor and stator as low as possible. To do this one must use "pig-tailed" connections. These are best made from pieces of the braid that is used in phone cords. On account of its flexibility its use is highly desirable. A piece of sufficient length to permit the complete rotation of the rotor is soldered to the ends of the coils to make the proper connections.

Two mountings are described in this article, either of which may be adopted as the constructor sees fit. Both are for panel mounting.

The first of these makes use of the standard plug that is used to mount lattice coils. The mounting is shown in cross section in Fig. 1. One of these plugs is procured and between the two connection elements a hole about 3/10" in diameter is bored. This forms the bearing that the rotor is attached to. The "pin" is then cut off to a length sufficient to allow it to project through the panel far enough to permit a nut being threaded on it. Also the "socket" is tapped to allow a machine bolt being inserted in it. This enables the mounting of the plug on the rear of the panel. The brass rod to be used as a shaft should be about 2" and ¾" long and should be threaded on one end for about ½". It should be of such a size that it will fit rather tightly in the hole that has been bored through the plug. The stator is then mounted on the plug in the same manner that the lattice coils on the market at the present time are mounted. Exactly opposite the hole bored in the plug the wires of the stator are forced apart and a short section of glass tubing of sufficient size to permit the free passage of the shaft is inserted. This will prevent the shaft from making contact with the stator winding. The shaft is then inserted in place with the threaded end inside the winding. A small washer is placed on it and a nut run down on the treads about ½". A washer cut from some stiff material such as formica is next placed on the shaft and then the rotor winding. The wires of the winding should be forced slightly apart to prevent the shaft injuring the insulation. Another washer is then placed on the shaft and the whole clamped tightly in place with another nut. A small spring between the panel and the dial will prevent the shaft from moving backwards and rubbing the stator winding.

The second mounting is illustrated by Figs. 2 and 3. A small brass angle piece clamps the stator winding to the panel. For further support the wedge shaped pieces of wood which are shown in Fig. 2 are screwed to the back of the panel. These serve to



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GET THE BEST service out of your expensive tubes by using *good* rheostats. Shramco Reos, with genuine "Nichrome" resistances allow unusually accurate and delicate variation of the filament current. All metal parts brass. Spring phosphor bronze blades. Mounted on a solid block of asbestos insulation.

For Detector and Amplifier Tubes—Shramco Reo, type 90. 6 ohm resistance, 3" base. Price $2.00 plus postage for two pounds. Also the Shramco Midget Reo, 5 ohm resistance, 2½" base. Price $1.50 plus postage.

For Transmitting Tubes—Shramco Reo type 90T, 1.5 ohm resistance. Current capacity 6 amperes. Price $2.00 plus postage for 1 pound.

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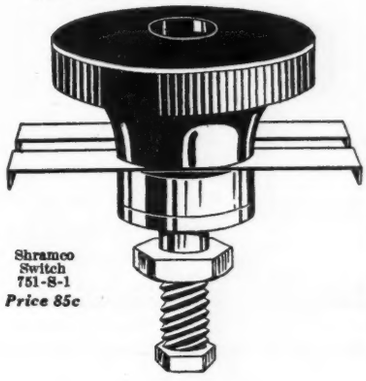
Either of these two styles will distinguish itself by smooth operation and sure contacts, in addition to the handsome appearance. Both have polished nickel finish and are furnished with large Marconi type knob. Bearing block and panel bushing ¾" in diameter. For use on all panels up to ½" thick. Blades, spring phosphor bronze. No. 750 type has spring tension adjustment; switch radius, 1½".

No. 751-S-1 type is provided with split lock nut; blades have 1" radius, ½" from center to center, and are securely held in place. If your dealer cannot supply you, send your order direct, postage extra.

Shramco Switch No. 750 *Price 75c*



Shramco Switch 751-S-1 *Price 85c*

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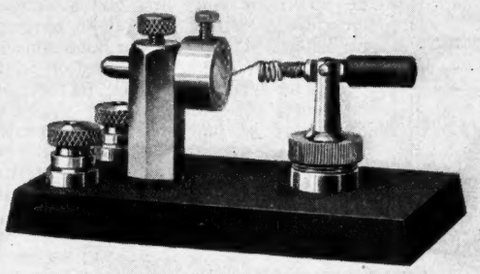
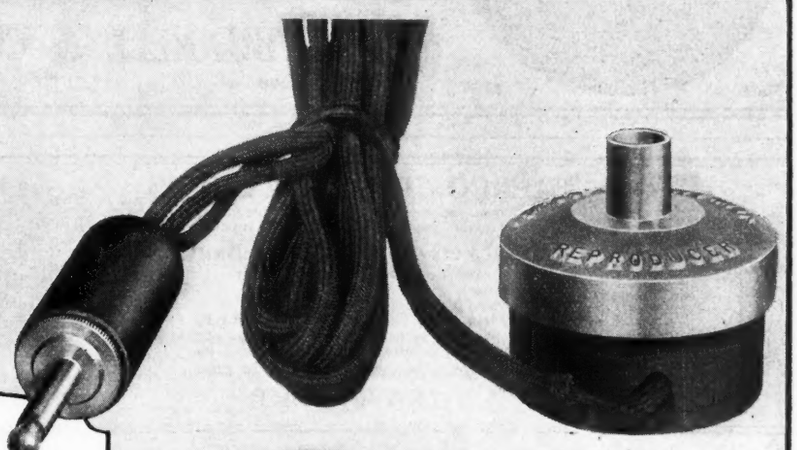
DEALERS—*Shramco Reos and Switches bring you good profits because they sell so fast and give complete satisfaction. Write for liberal discounts.*





MAKE YOUR OWN LOUD TALKER!

NEW Vocaloud phonograph attachment fits tonearm of your Victor or Columbia phonograph or metal horn. This outfit consists of a Vocaloud reproducer, altered in accordance with Firco engineering design, with special moulded cap, six feet of silk covered cord and Firco round type "Bull-Dog-Grip" Plug, complete for $14.00.

FIRCO Rheostat. Mount the Firco resistor and the Firco Type 7-A switch on your panel and you have a professional type Rheostat, 100% air cooled and closely variable. Switch 90c, Resistor 50c. Both together $1.30.

HERE is the Crystal Detector exactly as used on the Kolster Decremeter. The most easily adjusted detector ever designed. Satisfaction guaranteed in direct comparison with any other type of Crystal Detector. Price $2.50. Silicon Crystal 25c. Supersensitive Galena Crystal, 40c. Both mounted in Woods' Metal.

FIRCO Jacks and Plugs. "Bull-Dog-Grip" interchangeable telephone plugs. Flat type, 34A, $2.00, round type, 34B, $2.50. Firco Jacks, 99% sterling silver contacts. Nickel silver instead of phosphor bronze springs. Open circuit 65c. Closed circuit 80c. Double circuit 95c. 3 spring automatic filament control Jack, $1.15. 5 spring automatic filament control Jack, $1.40.

Examine these and other Firco products at all leading radio dealers.

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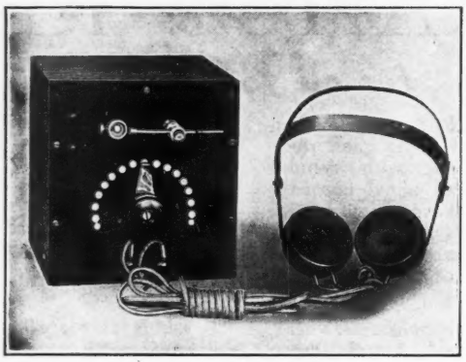
Ask your dealer to show you the new Firco-Clad transformer. Slightly larger than the Saco-Clad. Ratio 1:9. Price $7.00.

EMPIRE RADIO TELEPHONE RECEIVER

Price $16.00
Postpaid



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1 cabinet, containing tuning inductance, crystal detector, fixed condenser. etc.
1 Pair 2,000 ohm Murdock telephone receivers.
150 feet No. 14 copper aerial wire.
6 Insulators
Instructions for installing and operating.

Send 10c for catalog, money credited to first dollar purchase.

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No. 44R is now ready for distribution. Send 5c stamps for copy. It has many new and interesting devices.

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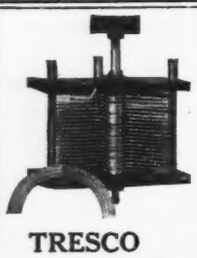

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When you think of tuners say TRESCO.
One for every need and wave length.

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Assemble them and save money

11 Plate.....$1.80
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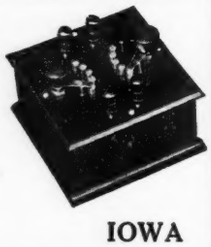
If you want us to assemble them for you add $1.00, plus P. P., to above prices. Shipping weight 2 lbs.
10c. brings a wonderful catalog of 24 pages.



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TYPE RF-1, FOR AMATEUR RANGE, $6.00

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The Type RF-1 is a—
Transformer of special type R.F. iron core construction. (Patent pending.)
Transformer having complete shielding.
Transformer covering the amateur wave-length efficiently.
Transformer giving maximum amplification per stage.
Transformer designed by former Government radio engineers.
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prevent the stator from "wobbling" up and down. The mounting of the rotor coil is the same as in the mounting just described.

Connections are now made between the two coils as previously described using the braid obtained from old phone cords. Either a series or parallel connection may be used bearing in mind that inductances in series add, as do resistances and that in parallel they behave as do resistances in parallel. The series connection is the one that is adopted as a rule. The finished variometer may be considered ready for use.

Radio Business is Booming

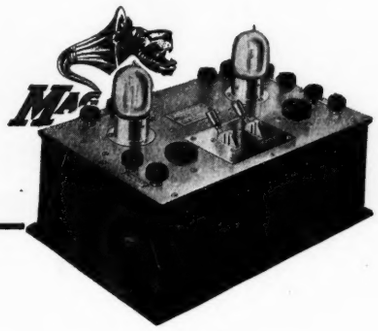
(*Continued from page 592*)

bugaboo of mystery with which radio has formerly been shrouded.

Today, we find radio departments being established in the larger department stores, in electrical supply houses and even in the country general store, where the storekeeper knows as little about radio as he does about the fourth dimension or relativity. All he has to know now is that, with the little machine he purchases from a radio manufacturer, it is but necessary for his customers to connect a wire to Mrs. Jones' chimney, the other end to one binding post of the machine and another wire on the machine to a water pipe, in order to bring all sorts of entertainment into their homes.

In this particular connection it is well, perhaps, to point out a single circumstance which is characteristic of many others. In a New Jersey town there is a store which, in the past, has been satisfied to sell sporting goods and cameras and phonographs and records. The manager was recently attracted by an exhibition of wireless telephone music, while on a visit to Newark. He inquired the price of the small receiving equipment necessary for receiving such music and found that he could sell them for a reasonable figure, with an attractive profit. He ordered six complete receiving sets, put one up in his store and had a number of signs made, telling the public to come in and listen to wireless telephone music sent out by the Westinghouse Station in Newark. The terms on which he bought the sets were, 2% ten days, net 30. On the eighth day he had sold his demonstration outfit, which was the last one of the six he purchased. He discounted his bill, and made a very good profit without having to invest a single penny and his sales are still quite attractive, although he could hardly expect to keep up such a rapid turnover. Eventually this dealer will find radio attractive enough to stock other forms of receiving apparatus and general accessories, but the important consideration is that he has begun as a radio booster. There are thousands like him, throughout the country, who are just waiting for the manufacturers to get their message to them. With such dealers, it will not be many years before we may look for "Radio in Every Home."

In the Metropolitan District there is a very large electrical supply house, which has recently made a great many alterations in its floor space. In making the alterations, the radio department has been very greatly increased. The number of showcases devoted to radio has been doubled and radio now occupies half of one of the windows. This particular supply house is one of the largest in New York and one may purchase practically any kind of electrical appliance there, whether it be washing machine, iron, vacuum cleaner or the heaviest copper cable. Is it not to be considered remarkable and an achievement for radio to find it occupying such an important



The NEW Magnavox 2-Stage Power Amplifier

Designed for use especially with the Radio MAGNAVOX for the distortionless amplification and reproduction of radio telephone speech and wireless music. Note the master switches to make stage to stage switching quick, simple and easy. No jacks. Can be used with any transmitting tube with any voltage up to 1,000. Sits either flat or on edge.

Type AC-2, Model C, with solid mahogany case—price $80. At your dealer or direct from factory.

Type AC-3 Model C MAGNAVOX 3-stage Power Amplifier, same as above only 3 stage, $110.

Volume without distortion

There is one way and only one way to reproduce wireless music and messages in volume without distortion—that is with MAGNAVOX EQUIPMENT. *There is no substitute for the Radio MAGNAVOX.* Used in conjunction with the new MAGNAVOX Power Amplifier, it reproduces in perfect, bell-like tones the slightest modulations of music or voice and swells them in volume a hundred fold, if desired, so many persons may hear and enjoy simultaneously. Buy from your Radio dealer or write us direct. Be sure it's a MAGNAVOX—"The reproducer with the movable coil. Look for the trademark on the horn.

The Radio *MAGNAVOX*

—the reproducer with the movable coil (Patented), the one instrument that will faithfully reproduce sounds and signals in any volume desired, without distortion and without injury to the apparatus. No set complete without one. Anyone can operate it. Full instructions free with each outfit. Type R-2 with 22" horn, price **$110.**

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Never in the history of radio has there been such a catalog.

The radio data and diagrams embracing upwards of fifty pages gives the experimenter more valuable and up-to-date information than will be found in many textbooks selling for $2.00, and $1.00 could be spent for a dozen different radio catalogs before you could gather together the comprehensive listing of worth while radio goods found in this great catalog.

A brief summary of the radio goods listed in this catalog:

The entire radio catalog of the Radio Corporation, with a wealth of scientific and technical data on C.W. transmitting sets, and all the diagrams for the assembling of these sets; the complete Remler catalog, which embraces 25 pages, the Westinghouse, Firth, Murdock, Federal, DeForest, Clapp-Eastham, Brandes, Connecticut Company, Thordarson, Turney, Magnavox Company catalogs, the best products of Adams-Morgan, Signal and countless other manufacturers, including our own complete line of radio apparatus, and many individual items and parts used in radio work today.

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We want live responsible dealers in every city and town in the United States, both for the sale of our extensive line of radio apparatus and all other worth while lines of radio goods on all of which we can quote attractive dealers discounts. We can offer you facilities and advantages that no other radio house can offer.

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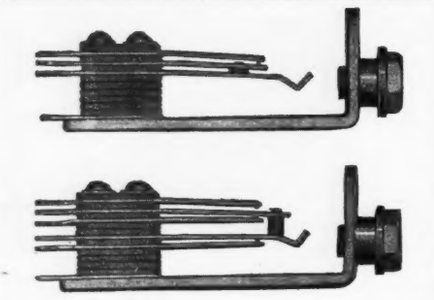
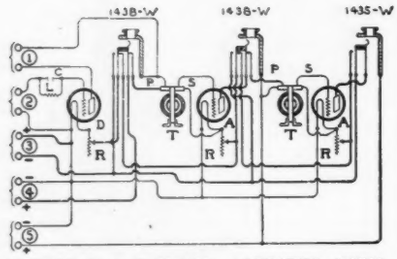
THE WILLIAM B. DUCK CO., 231-233 Superior St., Toledo, Ohio





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NOTE
1—To Tickler Coil
2—To Secondary
3—To "A" Bat. 6 Volts
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C—358-W Grid Condenser
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Simplify Your Radio Set

Eliminate innumerable switches and complicated controls by equipping your radio Detector and Amplifying units with

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Simplify operation; save current; make your set up-to-date and efficient.

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Keep up-to-date. Learn about all the big recent improvements in radio apparatus.

84 pages chock full of best and biggest values of America's 51 leading manufacturers. Most complete, includes everything.

TWO N-S LEADERS

Red-Head Radio phones, 3000 ohms, military head band with cord complete. **$8.00** per pair

Arlington-Tested Crystals; Galena or Silicon. Certified super-sensitive. **25c** per crystal

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position in this establishment? Does it not indicate very conclusively that the radio department has proven itself to be an asset? There is not another single department in the store, which is given as much floor space or window space.

There is one manufacturer in New York who has recently almost doubled the output of his plant, but whose orders have come in such numbers that even with this radical increase he is now compelled to keep his factory working overtime. By doing this it is just possible for him to keep up with his present orders and if his business increases for the next six months with the same speed which has characterized it for the past six, it will be necessary for him to redouble the size of his plant and the present indications are that such will be the case.

There is another New York manufacturer who has recently developed some very unique departures and improvements in transmitting and receiving apparatus, which he can not attempt to manufacture until he can find some method of increasing production, which is now at its peak, with most of his plant employees working day and night.

There is an Eastern manufacturer making telephone receivers specially designed for radio work, who is now approximately 7,000 pairs behind his present orders, even though his production is approximately 300 pairs a day. From this item, alone, it would seem as though radio is booming with leaps and bounds, for any manufacturer would make some provision for such increased demand, if the demand were not practically doubling itself every few months, as it is in this case.

In reply to a letter written by the author to a Western manufacturer and dealer on this subject, with no mention made of the fact that the information was to be used for publication, we find that business in the Middle West is just as good as it is in the East and on the Pacific Coast it is just as good, if not a little better. In the Middle West, this informant advises, there are many electrical supply stores which are beginning to handle radio and there is not one of them which has abandoned the line once it has been started. In the far West, there is much interest being displayed in the wireless telephone concerts which are being sent out from a number of different radio headquarters. This has greatly stimulated the sale of receiving equipment, as the broadcasting has done in the East.

A New Orleans radio man tells us that there are still but few wireless telephone stations thereabouts, but that the amateurs are showing great interest in C.W. and it will not be long before there will be a demand for receiving sets there, such as characterize the other sections of the country. The number of dealers in the city is somewhat limited, but they carry a very good stock which they are continually increasing. The business, though greater than ever known in radio in that section, needs the assistance of some wireless telephone station which will make interesting entertainment for the man in the street, down there, as it has here.

A VERY BRIGHT FUTURE

With all this increase in business the question naturally arises, "Will it continue?" In answering, it is quite safe to say that it will continue for several years, if not indefinitely. There may be an occasional slackening, but it will be nothing more than the release of tension which is noticed in a kite string when the kite hits an air pocket only to increase the tension again with the arrival of the new breeze. There are now not many more than a dozen radio broadcasting wireless telephone stations for the furnishing of entertainment

SPEEDY SERVICE

When you want any standard make of radio instrument, and you want it quick, call on us. Shipping goods in a hurry is the best thing we do!

DeForest EVERYMAN Radio Receiver:

A complete crystal detector outfit for receiving wireless telephone concerts, news, sporting results, crop reports, etc. Price $25.00. Aerial equipment $6.50 extra.

SPECIAL—Storage batteries, 6 volt, 60 amperes; regular price, $18, now only $14.40. *Order at once, supply limited.*

FEDERAL PLUG—(Something new, fits any type of cord tip), $1.75.

VOCALOUD, the sensational loud speaker that requires no batteries, no adjustments, no extras. Station type in solid mahogany cabinet, $80.00.

KELLY & PHILLIPS
312 Flatbush Ave., Brooklyn, N. Y.

Send for **ABC** *Catalogue*

Here is a catalogue you cannot afford to miss, because it describes in detail the unusual mechanical and electrical features and simplicity of the complete ***A B C*** **line**

Sixteen pages, clearly illustrated, in two colors. Every price quoted in this catalog represents a new low level for apparatus of recognized quality.

Send 10c for latest ***A B C*** catalog, "Professional Radio Equipment at Amateur Prices." Request Catalog CR12.

WIRELESS EQUIPMENT CO. Inc.
32 Austin Street, Newark, N.J.

The Midget "FIVE-IN-ONE" Slide Rule is a combination Mannheim, Log-Log, Add and Subtract, Polyphase and Binary Slide Rule. It will instantly add, subtract, multiply and divide any combination involving whole numbers, fractions, decimals and mixed numbers. Gives every possible root and power of every quantity. The graduations are printed on metal coated with white celluloid and are grease and waterproof. While it is the most versatile calculator ever invented, its operation is simple and easily understood. Diameter 4".

Price with 16-page Instruction Book, $1.50. Leatherette carrying case 50c extra. Catalog free. Your money back if you are not satisfied. **Gilson Slide Rule Co., Niles, Mich.**

4th District! 5th District!

MR. AMATEUR!

Is your name on our mailing list? Write for Bulletins of New Apparatus! We carry the only complete stock in the South. Try our Service once and become our Customer. Estimates on Installations Free.

SOUTHERN RADIO SUPPLY COMPANY
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DO YOU HAVE TO BE SHOWN ?

That "Missouri" Service is of the better kind. Real service. That we actually ship orders a few hours after we receive them, that we have a large and very complete stock of all standard apparatus and parts from which we fill your order, on hand at all times. Therefore "Missouri" is ready to show you. Send us a trial order.

REGENERATIVE RECEIVERS

No. CR-3 Grebe 175-680 Meters Relay Special.	$65.00
No. CR-5 Grebe 175-3,000 Meter Ideal Receiver	80.00
No. CR-8 Grebe 175-1,000 Meters with Tube Control	80.00
No. CR-9 Grebe 175-3,000 Meters with Det. & 2 Stage Amp.	180.00
No. CR-6 Grebe 175-680 Meters with Det. & 2 Stage Amp.	160.00
No. ZRF Clapp-Eastham	88.00
No. RA Westinghouse	65.00

TELEPHONES

No. 56 Murdock 2,000 OHM	5.00
No. 56 Murdock 3,000 OHM	6.00
No. C Baldwins	12.00
No. E Baldwins	13.00
No. F Baldlwins	14.00
No. Brandes Superior	8.00

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No. 181 Tuska Cap. Feedback	7.50
No. 182 Tuska Split Filament	10.00
No. 183 Tuska Grid-Tickler	12.50

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No. UP-1626 Radio Corp.	11.50

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No. 813 Remler 3 Amp	175
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No. UV-200 Radiotrons Det.	5.00
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Send us your orders for Radiotrons, our stock is complete.

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No. A-2 Acme	5.00
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Wire .....75c. per 100 foot.
Bare Copper 80 ft. to the pound—$.40 per lb.

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No. Y-1 Acme	10.00
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We have a complete stock of standard apparatus if there is anything that you can not find in the above list just send your order for it at the regular list price and it will be shipped at once to you.

SEND YOUR ORDER IN NOW!

YOUR ORDER WILL RECEIVE OUR PROMPT, CAREFUL AND APPRECIATIVE ATTENTION

OUR MOTTO

WE GIVE ALL WE CAN FOR WHAT WE GET
Instead—OF GETTING ALL WE CAN FOR WHAT WE GIVE

MISSOURI RADIO SUPPLY COMPANY

4623 MARYLAND AVENUE **ST. LOUIS, U. S. A.**

Buy By Mail At Reduced Prices

The standard products listed below are guaranteed to be mechanically perfect. They can be bought from us with the same assurance of quality that you would have if you bought them from a local dealer.

RHEOSTATS

Paragon (new low price)	$1.42
Fada (new low price)	.95
Gen. Radio	2.38
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Radio Corporation	3.00
Remler	.95

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Grebe CR-5 150 to 3000	76.00
Grebe CR-8 150 to 1000	76.00
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General Radio (new type)	4.75
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Radio Corporation	7.00

MODULATION TRANSFORMERS

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Small size 22½ volt	1.42
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Grid Condenser 0005, 0003, 0002, 00025 with leak	.38
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7 Strand No. 22 tinned copper, per hundred feet	.95
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Large insulated binding posts	.15
Small insulated binding posts	.10
Consolidated short wave regenerative set of blue prints	.47
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Brown (ENGLISH NAVY) adjustable	17.10
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Connecticut type 5176-A	3.80
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Crosley	.57
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Remler	1.42
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Adams Morgan	5.70
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Firco (BULL DOG) round type	2.50
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Type JT Radiation Meter thermo Jct 0 to 1.5, 0 to 5, 0 to 10	11.40
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TeCo Audistron adapters	1.66
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Radeco Fuses (four for)	.95
Anti capacity contacts, per dozen	.43
Fada (New Style) panel switch	.47
Fada Crystal Detector	2.14
Fada Series parallel switch	.71
Unmounted tested minerals Galena	.22
Mounted tested minerals Galena	.47
Ajax Buzzers	.57

For any article you want, not listed, deduct 5%

TECO RADIO CO., **P. O. Box 3362** **BOSTON, MASS.**

MEMORIZE CONTINENTAL CODE ALMOST INSTANTLY

BKUMA YRLSBUG

Two Hundred Beginners in Forty-Four States Have Reported Mastered Code in 30 Minutes. In 45 Minutes. In One Hour, One Evening, Etc., Etc

Anybody who can read can learn code quickly and easily.

After one hour study of your Chart I knew the Code. Can now send 10 and receive 8 words per minute.

Later: I think your Code Memorizing Chart is certainly great. Passed examination very easily and feel that my success is largely due to your simplified method. A friend who also used your method and has had his set only about a month can now copy about 12 words per minute which is considered a very good record.

Roland Richardson, Oakland, Calif.

Call 6AVH 4258 Foothill Boulevard. Worthless methods are advertised as best, easiest, quickest and other enticing titles. To avoid disappointment purchase no Code Memorizing Chart, Card or Device until satisfied by statement from actual user that same has proven efficient in use as well as in theory.

BY USING
DODGE RADIO SHORT CUT
BEGINNERS DO

Master the Code easily, quickly, permanently Pass Govt. Examination and receive License Once tiresome task—now pleasant pastime

THOSE WHO HAVE FAILED

after diligently trying all Methods heard of DO succeed with Dodge Short Cut

RADIO OPERATORS DO

gain better command of the Code, increased speed and greater accuracy

MORSE OPERATORS DO

change to Radio quickly, easily—no mixup.

REPORTS FROM BEGINNERS AND GRADUATES WHO HAVE BECOME LICENSED RADIO OPERATORS

tell the story: also give local addresses.

SEND 10 RED STAMPS FOR REPORTS AND INFORMATION

THESE REPORTS ARE

the concrete and tangible expression of desire by our highly successful students to aid and encourage present and future beginners to equally quick progress over that rocky place in the road to Amateur Success—Perfect mastery of the Code. The amateur of today will be the top notch operator of tomorrow.

INVESTIGATE

NO BEGINNER CAN AFFORD TO IGNORE quick and easy success of those who have used **DODGE ONE DOLLAR RADIO SHORT CUT WHICH TEACHES WITHOUT INSTRUMENTS AND HOLDS THE RECORD FOR SIMPLICITY, EFFICIENCY, ECONOMY AND QUICK RESULTS.**

C. K. DODGE

Box 200 MAMARONECK, N. Y.

ANNOUNCING

PARL B BATTERIES

QUALITY LONG LIFE LOW PRICE

Variable Taps	Type	Voltage	Plain
$1.45 5	Small	22½	$1.25
$2.50 5	Large	22½	$2.10
$4.45 6	Large	45	$4.00

Shipping wts.: small, 1 lb.; large, 5 lbs.; 45 volts, 10 lbs.

Do you want to use B Batteries as your source of C.W. or radiophone power? If so, write for discount stating quantity. These B's will do the work well at the lowest cost.

This service saves you money. Get that discount.

LOW PRICES—Get our radio supply list.

January BARGAIN in classified ads. Look!

Wavemeters Calibrated to 1000m. 35c per point.

Port Arthur Radio Laboratory

Harris Building PORT ARTHUR, TEXAS

Write For Our FREE BOOKS On

PATENTS

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631 Woolworth Bldg.....NEW YORK
Scientific American Bldg....WASHINGTON, D. C.
Tower Bldg.....CHICAGO, ILL.
Hobart Bldg., 582 Market St., San Francisco, Cal.

and it is generally admitted by those intimately associated with radio merchandising that the one greatest asset of amateur radio today is wireless telephone broadcasting of entertainment.

In this connection it may interest you to know that the plans of one radio manufacturing organization include the erection and operation of 16 such stations within the next few months. This company has already put several stations in operation and the business in the vicinity of each has gone ahead with a pace hitherto never dreamed of.

Rash prognostications would not be in order and it is not my intention to make them; rather would I ask you to draw your own conclusions: within a few months there will be enough wireless telephone broadcasting stations in operation to furnish entertainment for the entire country, from North to South and East to West, so the man in the street may have opera or jazz in his home by merely turning a little knob; there is something interesting in radio for every member of the family and new applications will increase this interest. Does it not seem reasonable to you that business will continue to be good?

The following very striking information was brought out in a conversation with the manager of the radio department of a large New Jersey department store. For many years past this store devoted a large part of its floor space to photographic supplies, which included cameras, films, papers, developing and fixing compounds and all the other impedimenta which go to make up the amateur and professional photographer's game. There were five show cases used to display this stock and there were five racks of shelves behind the cases whereon the stock was kept. Upon visiting the store in the early part of December, I was surprised to find that the photo department had been very greatly reduced and that where there had been but a singl case devoted to radio there were then five cases with their corresponding shelf space.

The gentleman in charge said that there were formerly but one salesman and a girl, though the force had been increased to five and was soon to be further augmented. He pointed out that he had purchased two dozen pairs of a single brand of popular-priced headsets that morning and there were but two pairs on the shelves at three in the afternoon. And the fact is further emphasized by reason of the day being Monday, which is ordinarily not the best day for retail radio.

The great bulk of the business done in this store was in the more moderately priced apparatus, though the demand for the higher grade equipment is steadily growing.

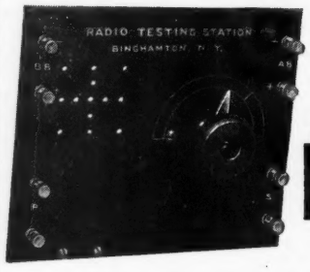
In this department were to be found several innovations, not the least of them being the employment of licensed First Commercial Radio Operators, in uniform, as salesmen. Their licenses were framed and hanging in a conspicuous place. Is there any better method of letting the public know that they are receiving intelligent service than making it quite apparent to them that those who assist them in filling their needs, are familiar with those needs for having once needed the same articles?

Though December is the month for toys and this radio department is on the same floor as the toys, observation disclosed the fact that there were just four times as many customers in the radio department as any other department on the floor. The average purchase made by customers of the radio department has been found to be greater than any other department on the floor, and the number of purchases per day has also been found to be greater, with the exception of such departments as handle very cheap articles exclusively.

Another very striking bit of good news

Wonderfully Perfected

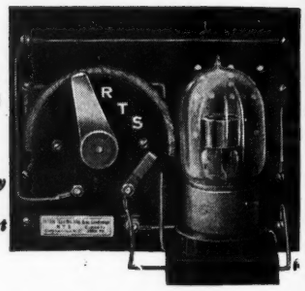
RTS STANDARD Detector Panel



RTS

Price $5.95 *without tube*

Prepaid by Insured Parcel Post



Install this efficient R.T.S. Panel and you possess a correctly designed Detector Panel capable of producing signal strength unequalled by any other tested in our laboratory. It is guaranteed.

Write for Circular

RADIO TESTING STATION

Dept. 5, 25 Sturges St.

Binghamton, New York

Panels

OF GUMWOOD BLACK FINISH

Treated with a special process made by us. Will not Warp or Shrink and is not effected by Temperature changes Waterproof and possesses High Dielectric properties. Easily machined and will not Crack or BREAK. Looks as good as Bakelite. We are prepared to ship promptly the following sizes

6"x 6"x¼" thick..$.60	9"x12"x¼" thick $1.50
6"x 7"x¼" thick...75	9"x14"x¼" thick 1.75
6"x10½"x¼" thick.1.00	12"x14"x¼" thick 2.20
6"x12"x¼" thick..1.25	12"x21"x¼" thick 3.00

Strips 3½ x 6; 3½ x 8, $.40 each; 3½ x 10, 3½ x 12, $.60 each; 3½ x 18, $.75 each

Add Postage for 1 lb. for Panels up to 6 x 12 x ¼; and 2 lbs. for larger sizes.

We will be pleased to quote prices on these panels cut to a different size on receipt of your specifications. NO FREE SAMPLES.

TENSO MFG. CO. Marshall, Minn.

MAGIC MONEY MAKER
A MYSTIFYING NOVELTY

With a Solid Brass Stamp you apparently stamp from plain tin discs brand new dimes—carry it in your pocket and mystify your friends—Complete apparatus and full instructions 25 cents. Big illustrated catalog of Magic Tricks, Illusions, Novelties, Jokes, Mindreading included free of charge. Send a quarter today.

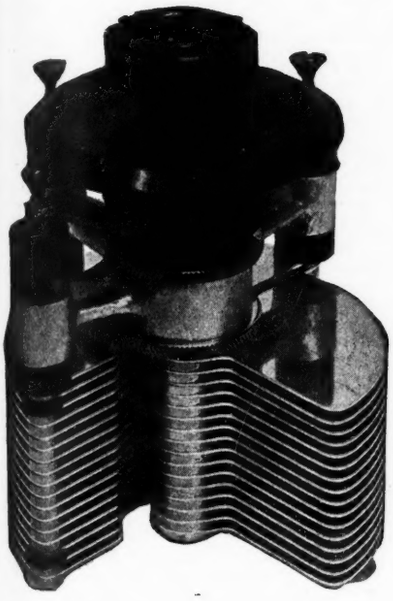
HEANEY MAGIC CO.
Desk S Berlin, Wisconsin

RECEIVE ON A COIL AERIAL ELIMINATE THAT QRM

Complete set of curves and tables giving wave length ranges of coils of various numbers of turns with different tuning capacities. 50c per copy.

C. A. DAVIS & CO.
2371 Champlain St., N.W. Washington, D. C.

Using An Inefficient Condenser is Like Carrying Water in a Sieve



The same judgement used in th e pur chase of radio equipment that you use unconsciously in everyday affairs will invariably lead you to select COTOCO condensers. Users are unanimous in proclaiming them *"the best."*

This condenser used in conjunction with our inductance units will enable you to build a set that you will be proud to own.

If your dealer cannot supply you with our products, advise us, and send us his name.

COTO-COIL CO., 87 Willard Ave., Providence, R. I.

THE BIG EVENT OF RADIO

The Second Annual Convention and Radio Show of the Executive Radio Council, Second District, will be held at the Pennsylvania Hotel, New York, March 7 to 11, 1922, inclusive.

Last year's convention and show was the biggest affair of the kind ever put over in the history of radio.

When you read in next month's issue, of all the wonderful things to be shown, talked about and done this year, you will immediately realize that this year's affair is going to be another smashing big success.

Executive Radio Council
Second District

Do You Want a First Class Commercia License?

When you decide to train for the wireless service bear in mind the fact that the Mass. Radio and Telegraph School has graduated more first grade and first class licensed operators during the past 11 months and has TODAY a larger enrollment than any other Radio School in New England. Send for our 44-page catalog giving full particulars to prospective students.

RADIO ENGINEERING

Classes meet each Thursday evening at 6:00 P.M.—enrollment limited. Subject. Design of Commercial Tube Transmitter.

WIRELESS TELEPHONY

CW-ICW. Vacuum Tubes. Classes every Tuesday evening at 6:00. Send for particulars.

AMATEUR CLASSES

Every Saturday morning from 10 A.M. to 12 noon—prepares for amateur license.

SALES—C-W—SERVICE

We carry a full line of Radio equipment and are counsellors on all radio problems especially complete receiving and transmitting installations—order from any standard catalog—mail orders filled. Our technical staff is at your service.

OPEN EVENINGS

Open three evenings per week. Monday, Wednesday and Friday until 9:30 P.M. and Saturday afternoon.

G. R. ENTWISTLE, Radio Director
R. F. TROP, Telegraph Director

MASSACHUSETTS RADIO and TELEGRAPH SCHOOL, Inc.
19 Boylston St. Boston, Mass.
Formerly Boston School of Telegraphy
Established 1908

Variometer	Price $6.00
Vario-Coupler	" $6.00
Junior Crystal Receiving Set	" $9.50

Send for Bulletin No. 11-A describing these instruments and our unit panel sets. See them at your dealer. Discounts furnished to the trade.

SIMPLEX RADIO COMPANY
1013-15 Ridge Ave., Phila., Pa

GALENA Unmounted Galena or Silicon **25c**

SILICON Mounted Galena or Silicon **50c**

Tested on Actual signals and Guaranteed Sensitive.
At your Dealer or Sent Postpaid
ROLAND BROWNLIE, Manfr.
24 Saunders St. Medford, Mass.

was communicated by the manager of another retail radio enterprise in New Jersey, who maintains a "listening in service" in a store on a rather prominent street. In a single day eighteen complete receiving sets were sold in his store.

Do Not Throw Away Your Old Phonograph Records

Unused or broken records can be heated with a blow lamp, rolled up and worked into all shapes while hot. They can then be pressed into moulds, and screw-heads can be heated and pressed into the surface. The moulded material can be turned at slow speed in a lathe, using paraffine oil on the tool and a finish can be put on with a fine emery cloth and oil, finishing with a dry cloth. It can be rolled out into thin plates, if placed between hot metal plates and passed through the mangle. Its uses are innumerable for switch handles, etc.

When cutting slots in disc records for coils, clamp the disc between two flat pieces of wood and saw through the three. This leaves a nice clean cut and prevents breaking the disc. The thickness of slots can be varied by using fine hack-saws and placing one, two, three or four together in the frame to get the proper thickness of slot.

Edmund Smith's Station 8BDI

(*Continued from page* 612)

pacity effects, when tuning. In the lower left and right hand corners of the formica panel are mounted the grid and plate variometers, respectively, the construction of which I described in the June issue of RADIO NEWS. Above the DeForest vernier condenser (which is between the two variometers) is an anti-capacity switch for throwing this condenser in series or parallel with the primary. On the left hand side of the switch is another variable, and on the other side is a variable grid leak. The third Groves coil, which may be connected as a tickler, is not used in the present circuit, since a tuned grid and plate circuit is in use.

The next (and last) cabinet contains the detector bulb and two-stage amplifier. Three holes in the (formica) panel allow the operator to view the tubes behind them. Beneath these are the switches to light the filaments. One rheostat controls the amplifying bulbs, but a separate one is used for the detector, which is a gaseous tube. The three point switch between the controls of the rheostats throws from spark to C.W. connection. This, of course, is not needed in the present circuit. The three jacks near the base of the panel are used to change from detector to one or two-step amplifier. The wood of these cabinets was finished in mahogany, and much care was exercised to design them so that they would be symmetrical in appearance, and yet have the instruments so placed that short leads and convenient control would be possible.

Above this cabinet is a loud speaker, which consists merely of a phonograph horn with a 1,500-ohm telephone receiver mounted at the small end. By actual measurement, this gives an audibility amplification of 11 times.

Next to the key, which, by the way, was made with carbon contacts to avoid sticking, is a rack for holding the unused duolateral and Groves coils. Behind this is a support for the Brandes phones, when not in use. Scarcely visible, behind the phones

QRK?

Hawaiian & German Stations Read With a Single Bulb

Are you satisfied with your receiving set? Would you like to build one that will receive over 6,000 miles on a single bulb and quit experimenting. One that will be the equal of any regardless of claims or price? Using the instruments you now have, you will be able to duplicate the long distance records you read about every day.

Get our simple diagram of a complete short and long wave receiver, 175 to 20,000 meters, with which we read Honolulu, California, German, South American, French and English stations and practically all the high powered foreign and domestic stations, amateurs as far west as New Mexico and numerous telephone and musical concerts come in good.

Diagram and complete instructions, leaving nothing to guess about, will be promptly mailed for 50 cents in coin or stamps. Wire a set up and quit wasting good money.

VIRGINIA NOVELTY CO.
MARTINSBURG WEST VA.

Wireless Amateurs *ATTENTION!*

If you want service, order from us. We carry a large stock of High Grade Wireless Apparatus of our own and other manufacturers.

SPECIAL!

Vacuum Tube Sockets	$1.25
Rheostats	1.25
22½ Volt "B" Batteries	1.50
Rasco Dials	.60
Rubber Binding Posts	.20
Tested Galena	.40
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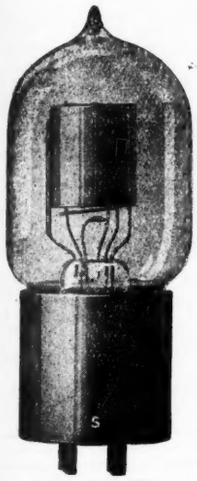

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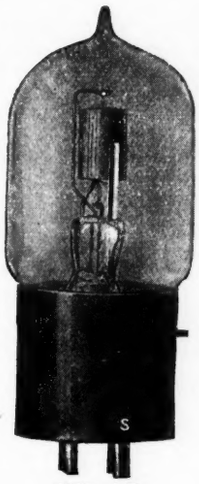

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In the Westinghouse Receiver Cabinet at the new Westinghouse High-Power Radio Telephone Broadcasting Station in Newark, New Jersey, the Westinghouse Electric & Mfg. Company are using A-P Tubes EXCLUSIVELY—the A-P Electron Relay, the most sensitive detector of spark signals known to the radio art, and the A-P VT Amplifier Oscillator, the tube the U. S. Navy uses.

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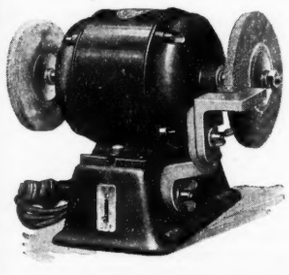
Think of it—a new, latest type ¼ hp single phase alternating current motor, guaranteed for one year, for $13.50!

This is lower than the before-war price. Motor is 110 volt, 1,740 r.p.m., 60 cycle, split-phase, fan-cooled induction type. Suitable for running washing machines, churns, cream separators, ventilating fans, blowers, lathes, drills, etc. Furnished in two styles—with cord and plug as illustrated; or with binding post terminal (reversible type).

Motor weighs 24 lbs. bare, 33 lbs. boxed. It is the latest type of a large, responsible manufacturer, who guarantees every motor shipped, for one year, and attaches to each a **guarantee service tag**, serially numbered, which entitles owner to a new motor, by express prepaid, should defects develop within a year. Repair parts are always available at low cost; but motor is so sturdy and has so few parts that repair expense is negligible. Price complete, boxed, f.o.b. Chicago..... **$13.50**

Quantity Discounts—On 3 motor ordered in 1 shipment, price is $13.00 each; 6 motors, $12.50 each; 12 motors $12.25; 25 motors $12.00 each.

Send Cash With Order
or we will ship by express C.O.D. if you prefer.



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Above motor, equipped with 6 in. Norton No. 60 abrasive wheel; and 6 in. Hanson & Van Winkle Cotton Buff; complete with off-and-on switch and cord and plug.

Machine weighs 38 lbs. bare, or 52 lbs. boxed. It is ideal for the home garage or workshop, for grinding tools and cutlery and for polishing silver and plated ware. Also adapted to the heavy work of hotels and restaurants for the same purposes, and for general machine shop service. Price f.o.b. Chicago..... **$25.00**

This price is less than half the usual charge for a tool of this size and capacity.

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No. 22	$0.56	$0.68	$0.62	$0.45
No. 24	.60	.77	.67	.47
No. 26	.65	.88	.71	.49
No. 28	.75	1.10	.85	.52
No. 30	.85	1.24	.97	.53
No. 32			1.15	.55
No. 34			1.52	.59
No. 36			1.77	.69

Price on ½ lb. spools double above list.

All prices are net and include cost of spool and delivery charges via Parcel Post to any Post Office address in the United States; safe delivery guaranteed.

Send for Circular 21-A giving prices on other sizes, insulations and quantities of Magnet Wire. This circular lists "WIRE FOR EVERY WIRELESS PURPOSE."

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Theoretical and Practical Instruction in Wireless Telegraphy and Telephony under Competent Instructors. Evening classes formed monthly. For particulars write or call.

A FEW OF OUR WONDERFUL 1922 BARGAINS

Money back if not pleased. Assembled but not wired. $1.00 extra if wired. Federal Jacks with Amplifiers. Amplifier Panel per stage, $9.75; Detector Panels, $4.90; With Federal Jack, $1.00 extra. Any combination you wish in one Panel Type CK. Knocked down CW. receiver panel 7x9 drilled 2 Variometers forms in place, using your old Loosecoupler. It makes ideal spark receiver. All parts, $12.90. Many other bargains. Catalog, 5c

SOUTHERN RADIO LABORATORY, Dublin, Texas.

is a pile of now unmounted duo-laterals, whose plugs have been used to construct the Groves coils.

Radiophone from 2XJ, KDKA, 8LB, and 8PJ can easily be heard all over the top floor, while many spark stations come in as loud as they do without the aerial or primary coil plugged in. In the old days when I used to listen for the long-wave arcs (with 15,000 meter coupler) stations in Cuba, California and elsewhere were heard plainly on one bulb.

Under the table (which is home made) are the filament and plate storage batteries and the rectifier for charging the latter. The six-volt batteries are charged by a generator, located elsewhere.

EDMUND S. SMITH.

Experimenting With Amplifiers

(*Continued from page* 601)

the diaphragms, and consequently the grid condenser capacity, cause the bulb to spill over at each dot and dash. The audion must be quick to return to its normal position. This was improved upon by inserting the variable condenser V.C. across the windings of the audio-frequency amplifying transformer.

Here, there is a lot of room for thought and time will not be wasted if the experimenters get together on these schemes and endeavor to turn out something worth while from them.

Over the Wireless Phone

(*Continued from page* 605)

MR. G. (*sarcastically*)—What did the woman I was talking to say?

MRS. G. (*pausing a moment to wipe the tears from her eyes*)—I asked Mrs. Smith and she said her son's set was not sensitive enough to get the woman's voice.

MR. G. (*defiantly*)—She did not hear me talking to any woman. She lies and I will see her immediately and tell her so. (*He rushes from the stage.*)

MRS. G. (*reflectively*)—I wonder if Mrs. Smith has really told the truth? (*She notices that the bulbs on the wireless telephone are still burning brightly, but refrains from touching anything. She walks across the stage to look at the baby.*) The dear child is sleeping. (*She removes the pacifier from the child's mouth.*)

(*The baby awakes and begins to cry loudly.*)

MRS. G. (*contritely*)—I awoke my little Queenie, I will take you over to see the pretty lights. (*She takes the baby from the cradle and carries her to the wireless apparatus.*)

(*The baby stops crying.*)

MRS. G.—Does Queenie like to be in mother's arms? Pretty little child, you like the lights, do you not? (*She sits before the set.*) Look, Queenie, this is the telephone your father uses to talk with—(*she pauses and stifles a sob*)—yes, Queenie, some day when you are a young lady, a man who is interested in radio might marry you. Watch him!

(*The baby begins to cry.*)

MRS. G.—Don't cry, Queenie, I will walk around the room. (*She rises from her chair and walks with the baby across the stage and back again. A few moments pass in this manner.*)

(*Enter* MR. G., *breathing loudly.*)

MR. G. (*excitedly*)—Ran—ran from across the street to tell you that——

INSTEAD OF JACKS!

Here is something entirely new. Our Rotary Amplifier Control Switch with Automatic Filament Control. Takes the place of plugs and jacks. With our switch you can change from detector to any desired stage instantly by slight turn of knob, filaments of unused tubes being automatically extinguished. Built of phosphor bronze and brass mounted on bakelite. The neatest, quickest and most convenient control ever brought out. Panel space 1⅝" x 1⅝" x 2½". For detector and 1-2 or 3 stage amplifier complete, knob with pointer and diagram. Picture and more complete description in our folder sent free.
PRICE $6.00

Our Edgewise-wound C.W. Inductance will increase the efficiency of your C.W. or phone. 35 turns ¼" x .05" copper strip, 5½" in diameter. Heavy bakelite supports insure perfect insulation. Mounted on finely finished green weathered-oak base furnished with three clips with insulated handles. Photo on request. Price $6.00

Here is your chance to get a real Oscillation Transformer. Pancake hinged type, pri. and sec. 1" brass ribbon on heavy bakelite. Regular price $12.00. While they last $6.50

Complete stock of Magnet Wire 18 to 32 B-S D. C. C. and S. C. C., ¼ lb. spools or any quantity reasonable prices.

Fine Navy type Knob 1⅜" diameter with polished aluminum pointer. For ¼" shaft or with 10-32 threaded bushing.
With pointer .....35c Without pointer 15c

We will be pleased to quote lowest possible prices on any raw materials, parts or apparatus you may require. All goods carry our money back guarantee, if not satisfactory.

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You won't have 'em if you buy from us—Large stock—Lowest prices—Immediate shipments.

WESCO Magnet wire—½ lb. Spools.

B&S Ga.	Enam.	S.C.C.	S.S.C.
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26 to 30	.65	.95	1.30
32 to 36	.80	1.40	2.15

WESCO Aerial Wire	250 ft.	500 ft.	1,000 ft.
7-22 stranded copper...	$1.80	$3.50	$6.90
No. 14 solid copper....	1.15	2.00	3.75

Genuine Bakelite panels ⅛-in. cut to size 1¾c. per sq. inch.
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50 feet No. 11 square copper inductance wire ..... .75
6 Volt 100 amp. hr. Storage batteries. Special price at 22.50
WESCO Detector panel with UV tube. Special price at 10.50
WESCO Amplifier panel with UV tube. Special price at 16.00
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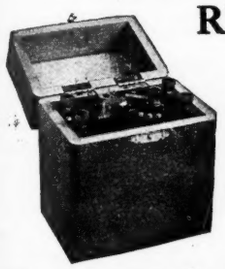
No exciting batteries or adjustments necessary.
Uses a Baldwin Type "C" single phone.

THE LITTLE WONDER PORTABLE RADIO RECEIVING SET



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Type S8, receiver only ..... **7.50 Postpaid**

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Amplitron less telephone receiver **$10.00**
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Type AVA Regenerative Receiver, $45.00. Wave Range 175-475 meters.

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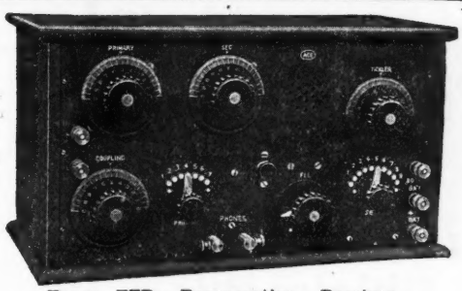

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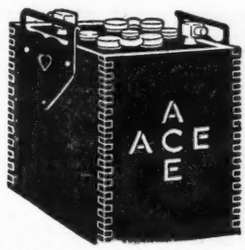

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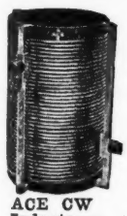

ACE CW Inductance $6.50

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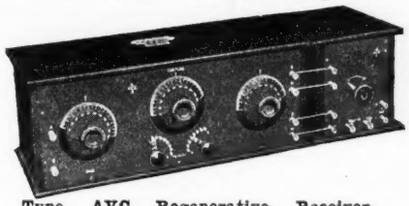
If your dealer cannot supply you write us direct



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All Wizard Batteries are absolutely guaranteed

ANNOUNCING WIZARD'S 2 NEW IMPROVED TYPE "B" BATTERIES

No. 1632—1 tap 45 Volt Var. Battery, Size 6x5x2¾ in.....Price $2.80
(Weight 3¾ lbs.)

No. 1630—6 tap 27 Volt Var. Battery, Size 6x3x2¾ in.....Price $1.80
(Weight 2½ lbs.)

These new types are not made of the same size cells as a small size "B" Battery. The volume of one of the cells in these types is 4.7 cu. inches as compared with 2.5 cu. inches, the volume of a cell used in small "B's". You can easily see that the life of these two types are almost double the life of the small "B's."

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Bakelite Panels, 10"x15"x3/16".2.65

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APEX RADIO SHOP
1105 W. 69th ST. CHICAGO. ILL.

MRS. G. (*interrupting*)—That Mrs. Smith told the truth.

MR. G. (*speaking slowly and carefully, with feeling*)—No, she was mistaken, that's all. You misjudged me; you, the one woman whom I have always trusted. My denials were nothing to you——

MRS. G. (*interrupting*)—But——

MR. G. (*sternly*)—No buts. Your misjudging me might have caused a separation. Luck was with me when I left the wireless telephone set in operation. Mrs. Smith heard you talking to the baby. I was in time to hear part of what you said myself. I also was talking to the baby when Mrs. Smith heard me, it was not another woman. I called her Queenie and said come to your daddy and a few other things like that. The baby was crying and I tried to amuse her by talking. Mrs. Smith misinterpreted some of the things I said.

MRS. G. (*crying*)—I am sorry and never——

MR. G. (*interrupting*)—Sorry! Think of the trouble you might have caused. (*He speaks calmly.*) But everything is all right now. Get dinner ready, Gerty!

(MRS. G. *leaves the stage, taking the baby and cradle with her.* MR. G. *goes over to the apparatus and turns off the current. He then takes up the line telephone, which is on the table with the wireless telephone.*)

MR. G. (*laughingly*)—Never again will I talk over this telephone to a young lady when my wireless telephone is also transmitting my voice.

(CURTAIN.)

The New Wave-meter of the Bureau of Standards

(*Continued from page* 587)

ing virtues. Among these are: Assurance of constant calibration by its rigid construction, its shield, its unimpeded progress through 360 degrees without "stop-overs" which would jar the plates from alignment. Also, barring air, its dielectric losses are negligible. Large semi-circular plates, unsheared at one edge or rounded at the corners, afford a capacity calibration curve nearly approaching linear from 5 to 170 degrees. Extremely low resistance or power losses of this condenser is guaranteed by the elimination of insulating material other than three short glass rods which act as non-conductors of electricity between the fixed plates and the movable plates and the shield. The topnotch capacity of the condenser is 0.0012 microfarad.

Fixed mica condensers are employed as sources of supplementary power. Four shielded condensers are accessible, having capacities of 0.001, 0.002, 0.004, and 0.008 microfarad, respectively. The phase angle of each does not exceed five minutes at 500,000 cycles a second. The high-potential terminals consist of rods climbing to the level of the top of the variable condenser, terminating there in mercury wells. Four other units of the latter are projected from the high-potential terminals of the variable condenser. Thus, by means of interchangeable links between the mercury wells any combination of fixed condensers may be placed in parallel position with the variable condenser. The fixed condenser of 0.001 microfarad is elevated on a metal column as a means of abbreviating its high-potential lead, a factor in the interest of curtailing any unwholesome capacity effects possibly resulting from long leads. The latter are made of $\frac{1}{16}$" brass rods, circumventing a square 25 centimeters on a side. Four uprights extend support to these leads, the two on the ungrounded side being built up of Pyrex glass as surety of low electrical

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6 x 12 x 3/16	1.35
6 x 18 x 3/16	2.00
9 x 12 x 3/16	2.00
8 x 18 x 3/16	2.75
12 x 18 x 3/16	3.85
12 x 24 x 3/16	5.35

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UV-200 Detectors	$5.00
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UV-203 50 Watt Oscillator	30.00
FADA Rheostats	1.00
FADA Power Tube Rheostat	1.35
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Baldwin Type C Phones	10.75
Baldwin Type E Phones	15.00
Baldwin Type F Phones	16.25
Cece ⅛ x 3/16 N. P. Switch Points, Per Doz.	.35

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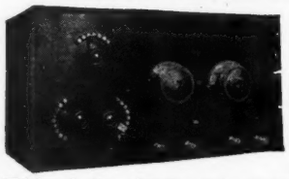

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Think of the pleasure and practical experience you will gain in making your own set, with wavelength range from 170 to 2,500 meters.
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resistance. The upright, in closest proximity to that terminal of the variable condenser which is connected to the shield, is of metal. It travels, so to speak, through the top of the truck on which the wavemeter is grounded, ending its journey in a binding post as a "ground." The shields of the fixed condensers are harmoniously joined to this binding rost. The fourth upright consists of a rod of conventional insulating substance. The leads are terminated in two binding posts into which the coil terminals may be thrust and clamped. All of the coils have terminals at the same height and distance apart.

Seven coils have been allotted for use with the standard wavemeter. Five of these are single-layer units of polygonal (a figure with more than four angles) cross-section. The coils are wound on skeleton frames, these being of laminated phenolic material. The latter, by the nature of their open construction, supply a condition as nearly approaching an air core as the requirements of fixedness and strength permit. The coils are wound with silk covered "high-frequency cable wire," each strand beng tested to determine a continuous thread. The turns of wire are placed in notches in the coil frame. The binding posts are securely pinned to the frame, a safeguard against the former unloosening themselves and twisting the wire. The shape of the coils is the result of a compromise. Low resistance, low effective capacity, and mechanical convenience, were the factors determining the outward appearance of what we call shape. Authorities on the subject of radio-telephony and radio-telegraphy of the Bureau of Standards reason thus in this particular: "It may be shown that of all single-layer cylindrical coils with a given inductance and a given spacing between adjacent turns that one will have the least conductor resistance whose diameter is approximately 2.46 times its length of winding. On the other hand the effective capacity of a single-layer coil is roughly proportional to its diameter and can hence for a given inductance be reduced by decreasing the diameter and increasing the length of winding to compensate. Since the resistance of the coil does not begin to increase at any very startling rate until the coil is made longer than it is wide, the shape may be varied until the length is as

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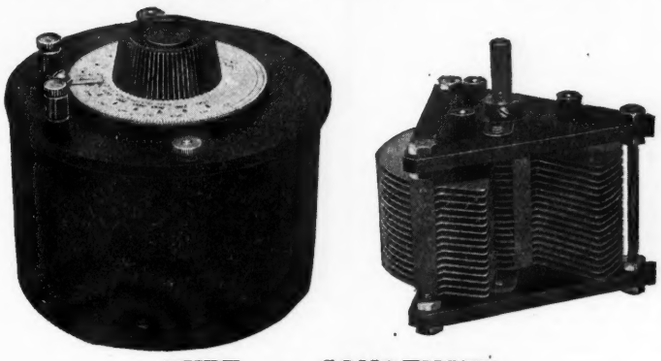

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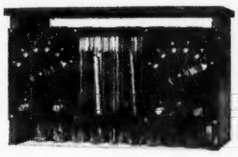

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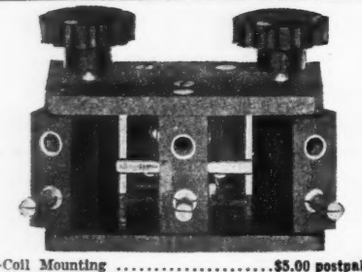

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22½ V. B Batteries, small size	1.00

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nearly equal to the diameter as is convenient mechanically."

Each of the five coils forming a component part of the wavemeter being described has a ratio of coil diameter to length of winding of 2.1, speaking according to the law of averages. These coils, with reference to inductance, have a range from 10 to 5,000 microhenries. Electrical factors determined the minimum limitation while the maximum figure was fixed in obedience to mechanical convenience. At present, the Radio Communication Section of the Bureau of Standards is constructing a coil wound on a skeleton frame resembling the single-layer coils just described, but the unit in the making is composed of three-spaced layers and will have an inductance of 23,000 microhenries. For an even higher inductance, a coil bank-wound with high-frequency cable wire on a Pyrex glass cylinder, the wire impregnated with collodeon, yields 128,000 microhenries.

Resonance is indicated, returning to the central theme of this article, by a single turn of a ⅛" brass rod coupled to the wavemeter coil. The terminals of the loop are terminated in mercury wells fixed at the bottom of an insulating cup. Practice heretofore involved the resting of a sensitive thermogalvanometer in this cup with its terminals merging in the mercury wells. Greater sensitiveness is obtained by exchanging this instrument for a thermo-element with leads to a wall galvanometer. This turn is fixed so that its coupling with any one coil of the wavemeter is unchanged. It is grounded on the side in closest proximity to the condenser. The standard wavemeter, which has lent itself to a detailed description in this story, is mounted on a modified form of the dish truck, manufactured by the Lansing Company, of Lansing, Michigan. The iron frame, representing strength, is grounded. The wheels, equipped with rubber tires, are six inches in diameter. They conform to the swivel type, with ball bearings at the swivel. The top of the truck is formed of heavy slab made from the durable maple tree. The fixed and variable condensers, the uprights supporting the leads, and the single turn employed to reveal resonance, are screwed to this substantial piece of wood. Shock-absorbers in the form of rubber cushions reduce to a negligible quantity the vibrations to which the variable condenser would otherwise be subject.

A New French Portable Radiophone Set

(*Continued from page 587*)

cuit; the switch on the left of the meter opens or closes the filament circuit of the tube, and the other, on the right, tunes the set on one of the three wave-lengths for which it is designed. At last, a coupling reaction coil may be adjusted by another knob below the meter, so as to obtain maximum intensity in the aerial. The buzzer may be run by closing a small switch and the change from "phone" to "C.W." is accomplished by means of a switch mounted on the buzzer base.

Faults of the "Q" List

(*Continued from page 597*)

official list of stations, a coast station gets from the land-line a message for a ship whose call sign is unknown. In the case of a newly launched boat or of one whose registry has been changed (for instance, from American to Canadian registry) the delay in receipt of the new call letters may amount to anything from one month to six months. There is need for an abbreviation to use in a case of this kind, to signify: "What is the call sign of —— station?"

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This would provide a means of requesting the call sign from a station which had received the supplement more promptly.

The abbreviation TR, meaning "tous renseignements" (all information), might well be furnished with a Q. As QTR, it would have a handier bulk in its present form, besides breaking the uniformity of the list, it occasionally is mistaken for the common abbreviation TR, meaning "there."

Does anybody really know what is meant by QSU—the joker of the list? Since its meaning is printed as either "I will call you when I have finished" or Please call me when you have finished," and as it cannot be used interrogatively, it is worthy of renown as an example of official lucidity. When anyone says "QSU" his intention is, in the language of the street, "as clear as mud." Lastly, and perhaps worst of all, wherever we see the list, that eyesore QRS seems to stand out in raised letters. QRS —"Send slower." Whoever mutilated the language by this ungrammatical expression —which occurs not only in the American, but in the British and Canadian versions as well—whoever he was, we will say he was no operator. QRS—"Send *slower!*" The French and German editions are free from this blemish.

The compilers of the "Q" list deserve credit for havig made an effort to solve a difficult problem, and the faults we have pointed out are certainly outweighed by the benefits which the list confers, and which are attested by the uses that is made of it on the seven seas. With the task of selecting the most frequently needed expressions from the vast number of hypothetical contingencies, they have made a praiseworthy attempt at accomplishing their purpose; but, that they did not bring to that task the experience of the radio operator, is the obvious explanation of the defects of their work.

That $1 Radio Set

(*Continued from page 607*)

nection, the radiator should be used. The pipe should be scraped to insure a good contact and the connections soldered if possible.

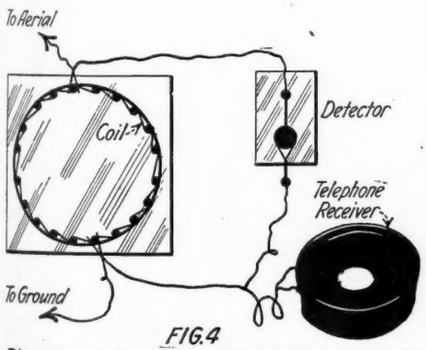

FIG. 4

Diagram of Connections of the Set With the Tuning Coil Inserted in the Circuit.

HOW IT WORKS

Once your detector is made and your antenna erected, with your ground wire fixed to a pipe, all that it is necessary to do, is to listen in the receiver while adjusting the detector. This adjustment merely consists in moving the sharp point touching the crystal until some signals are heard. If in a city, or in the neighborhood of transmitting stations, some signals almost certainly will be heard with the first attempt, provided the crystal of galena is a sensitive one.

With such an outfit, there are no tuning possibilities since no means of tuning are available and a great improvement to the set would consist in a tuning inductance, which may be made as explained hereafter.

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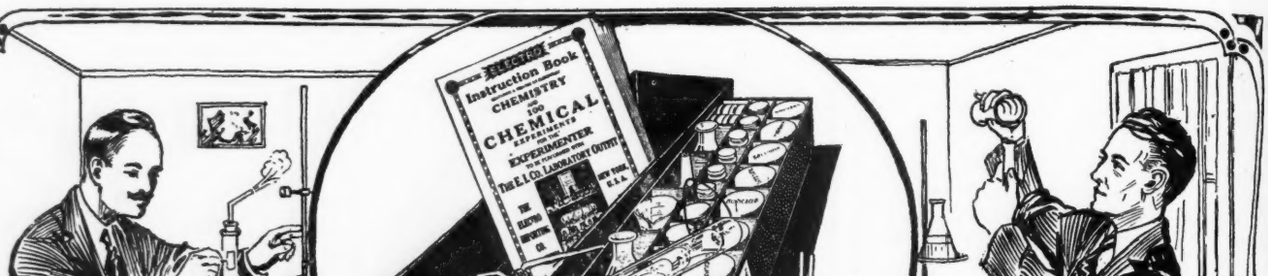

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A good part of the book is devoted to Weights and Measures. The Metric System, The English system and the U. S. System are fully explained.

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Iodine (I)
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Manganese Dioxide (MnO_2)
Mercury (Quicksilver) (Hg)
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Sodium Chloride (NaCl)
Sodium Nitrate ($NaNO_3$)
Sodium Phosphate (Na_2HPO_4)
Sodium Sulphate (Na_2SO_4)
Sodium Sulphite (Na_2SO_3)
Stannous Chloride ($SnCl_2$)
Sulphate of Nickel ($NiSO_4$)
Sulphate of Zinc ($ZnSO_4$)
Sulphuric Acid (H_2SO_4)
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One Standard Washbottle
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This inductance is not indispensable and spark signals as well as radio-telephony may be heard with the detector alone, but in several cases the intensity of the signal will be increased many fold by the use of such a "tuning coil."

CONSTRUCTION OF A SIMPLE TUNER

Fig. 3A shows a type of home-made inductance, which can be constructed very cheaply. It consists of a piece of wood forming the base, and 20 nails about 1½" or 2" long, driven into the board in a circle, as shown in Fig. 3C. To wind the inductance, about 265 of No. 24 or No. 26 double cotton covered wire, is necessary. The beginning of the winding should start at one of the nails, as shown in Fig. 3C, the wire, which should be scraped of its insulation, should be twisted around the nail to make contact and fastened. Then, two turns around the circle formed by the nails should be wound and the wire fixed to the next nail, No. 2, as shown in Fig. 3C. Twenty turns should be wound in the same manner with contacts every two turns made to the first row of 10 nails, numbered 1 to 10, in Fig. 3C. From the nail No. 11, 20 turns should be wound before a contact is made on the nail No. 12 and thereafter the same number of turns should be wound between each step.

This will form a total inductance of 200 turns and almost any number of turns may be inserted in the circuit by connecting the necessary sections of 20 and 2 turns between the antenna and ground clips. These clips making contact on the nails and shown in Fig. 3B, are ordinary paper clips and make very good contacts on the nails. The diagram of connections of the complete set, including the tuning inductance, is shown in Fig. 4.

To tune the set when signals are heard in the telephone, the clip making contact with the nails connected every 20 turns of the coil, should be varied, so as to increase the intensity of the signals; then, a fine adjustment is obtained by changing the position of the other clip which varies the number of turns in the circuit only two at a time.

This little set, which is easy to build, will provide a lot of entertainment to those interested in Radio and if near enough to a Radiophone broadcasting station, the voice will be heard quite clearly. This article describes only the principal elements of a receiving station, but additional information and data for the construction of other instruments will be given in future issues of this magazine.

Radio Control

(*Continued from page* 596)

5. Diving rudder up.
6. Direction rudder right.
7. Direction rudder straight.
8. Direction rudder left.
9. Diesel engine start.
10. Diesel engine stop.
11. Diesel engine starter on.
12. Diesel engine starter off.
13. Storage battery on charge.
14. Storage battery on discharge.
15. Automatic transmitter (sending long dashes for taking radio compass bearings) on.
16. Automatic transmitter off.
17. Radio vision system on.
18. Radio vision system off.
19. Radio telephone on.
20. Radio telephone off.

The radio vision system, which is operated by the relay 17 and 18, is a new device which shall be described in a future issue of this magazine and which uses the property of selenium to send by radio from the submarine what may be seen by the periscope, enabling the operator directing the submarine to see what is around it.

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for Marshall-Gerken Products has been so great that a congestion of orders for our most popular parts can only be avoided by concentrating our future efforts on the manufacture of the following:

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Radio Digest

(Continued from page 595)

and the experimenter "building his own," as well. By means of the charts, the number of turns on a coil for a given wavelength may be found, the capacity of a condenser to shunt across a circuit may be determined, to tune up to a certain wavelength. There is also given in this book all information for the design of single layer, spiral type, and bank wound coils, also the correct formulæ for certain calculations.

In a word, this useful book cannot be too well recommended to anyone engaged in radio activities, either as a professional or as an amateur, for it will prove handy at every instant during radio work, in the station or in the laboratory.

This book is published by the Wireless Press, 326 Broadway, New York City, N. Y.

The Phonoscope

(Continued from page 591)

plain and signals may be copied in a room where machines are running, producing disturbing noises which interfere greatly if the signals are received with ordinary phones. The illustration shows how a number of persons can listen at the same time and how the Phonoscope is connected to a Radio receiver.

The French Coast Station System

(Continued from page 608)

tinuous waves on 1,800, 2,100 and 3,000 meters, with a 6-kw. tube set, and can reach the liners crossing the North Atlantic during almost the complete trip from England to America. The French liners of the New York-Havre line, as well as those of the Bordeaux-Buenos Aires line, which have from 50 to 100 messages to send when they get within the range of the Coast station, would greatly benefit by having a continuous-wave transmitter with which they could reach the stations from a greater distance and send their messages without interfering with the low power spark sets of the cargoes and smaller ships, which are in the neighborhood of the Coast stations. At the present time, not having these facilities, the operators most of the time send their messages to Usshant on 800 meters after calling it on 600 meters. This method becomes more and more general, although it is contrary to the prescriptions of the International Convention, which are considered unsuitable on account of the rapid increase in the number of ship stations.

In the Brazilian Coast Stations, for instance, as well as in those of the Argentine Republic, the traffic with ships is handled on 600, 700 and 900 meters; also, the British, Spanish and Italians do not hesitate to facilitate the local traffic with their ships to break the London Convention regulations by using different wave-lengths and by increasing the power to answer the momentaneous need of the traffic.

The French Post Office Department has considered, as a means of simplification and reduction of interference, the erection of another station a few miles away from each one of the Coast stations in use at the present time. Both of these stations would be connected by land line, one of them handling all the traffic on continuous waves, the other one the traffic on damped waves, both of them working on three or four wavelengths, with a constant watch on 600 meters for distress signals and calls. The sta-

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tion working exclusively on damped waves would be used for short range work, while the other one equipped with a high power continuous wave transmitter, would keep in touch with the liners a great distance from the shore. These conditions, which would be ideal, are under study by a French Commission which will report soon the observations made and the advisability of proposing these improvements to an International Conference.

The Fable of the "Ham" and the 4KW

(*Continued from page* 605)

some of the Members began to get something else than Statics with their Apparatus. Ohms' Law was more or less under Observation at some of the Meetings and a few could Figure out their own Power Bill. Radio periodicals were Digested with more or less Assimilation of Contents other than the A.D.V.'s.

In other words, the Club Progressed.

Now, Alfred was not left in the Cold by this in any way, although reading always was Hard on his Eyes and he had to spell out any word that was longer than Cat. To use the Life Work of the great Webster did not Appeal and was too much Work, therefore "Whiz Bang" occupied the place in his Bookshelf that RADIO NEWS should have. His Capacity was about .0000000015 m.f.

He was Aware that Copper would Conduct an Electric Current.

Now the Town had a Paper, and when there was no Bargain Sale A.D.V. to fill in the Space, the Editor would run around to the Club and get a bit of News.

It was Thus that one day the Paper announced that the Club had been heard in Oschosk which was Miles and Miles away, and since the Editor had met a Friend who was Known to be an Expert on Home Brew, two whole columns were Devoted to the Article. In fact the Editor had Stretched his very elastic Imagination until it seemed that it would never regain Normalcy.

All of which did not Promote good Feelings on the part of Alfred toward the Club.

Traffic had by this time become so great that the Club Prescribed regular Hours for its members to Transmit in.

It was at just such Moments that Alfred had his Important Work to do, and when he opened up on the Ether with his quarter K.W. set, which was tuned like a Second-hand Concertina, you could hear him on everything from 9,000 meters down.

When Club members asked him to transmit at regular hours, they were told to Abide in the Place of no Coal Bills.

Alfred's sending Rate was about Three words a Minute, and if you were not Particular about the Spacing, he could Give you his like an old-timer.

He was in the Habit of sending everything, and if you were of Chinese Parentage you could perhaps have Understood some of it. The only Foolish thing that he did not try was to send the S.O.S.

The Club Suffered along for a while, and when some of the Back Dues were paid up, they made the purchase of a real ONE K.W. TRANSFORMER.

Now this at Times Bothered Alfred, and if his set had ever been in Adjustment he might have suffered a pair of burnt out phones.

So when one day he was looking through the classified A.D.V.'s, he ran across a 4-K.W. transformer. What this Meant as to Juice, he was Uncertain, but he was sure that it would Disturb the air.

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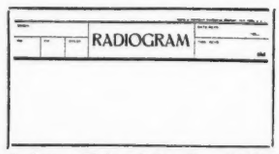

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press charges on some 300 pounds of Junk, Alfred went about the house with a Smile on his face. He would Transmit now. Somebody in that Club was surely in for a Pair of busted Eardrums.

Now, whoever Rated the Watt-Burner that had fallen into the Gentle hands of our Hero was not one to give a person Short Measure.

He might have meant that the output was 4 K.W., but then he would not have been accused of Lying. It was a Cinch that Alfred would put a Crimp in the Club that night.

By much guesswork he finally got the Primary leads hooked up with the power line, and the Secondary was more or less indifferently connected with the Oscillation transformer. That didn't Seem Right to him, but it could be changed if it did not come up to Expectations.

Night drew on, and Alfred waited until the Smart Alecs would be listening for X.Y.Z.

He closed the power switch and pressed the key.

Just what happened he never knew, for by the time the family smelled the burning rubber, he was probably taking out his harp check.

That is giving him the Benefit of the Doubt.

Two days later the Big "Doings" were Pulled off. The people attending said the Floral Offerings were Great and that Mamma looked well in Black.

Unaware of the Present Whereabouts of Alfred, we can only say that we bet he is not Transmitting. Perhaps he is listening to a Phone concert by the Golden Harp Jazz Band, on his new Celestial Regenerative Receiver. We think it Possible if the thing had but one adjustment and they were sending on a Broad enough wavelength.

Should his Address be Sulphur Bath No. 3, it is not to be wondered at if you would find him with an Asbestos Copy of "Elementary Principles of Electricity for Hams," by One Who Knows.

Moral:—Before you Work POZ, you had better learn the Code.

Data on a Chopper

By RUSSEL MESTER, 3ANJ

Having had much trouble with a buzzer, I decided to try a chopper. The first chopper I experimented with was 4" in diameter with 20 segments. By running this at 2,000 R.P.M., the tone faded out of hearing. The next one I made was 2¾" in diameter with eight segments, each segment and insulation being ½" wide. This is run between 2,000 and 2,300 R.P.M., having a brush bearing on the center of the disk, and one on each side of the disk bearing on opposite segments and tied together to make the other connection. I use ⅛" red fiber for the insulations and they are dovetailed in as shown in Fig. 1. The accompanying illustration shows how the chopper is placed in the circuit. When I use the chopper the radiation drops from .9 to .6½ to .7 because of the spring of the brushes and the speed of the motor.

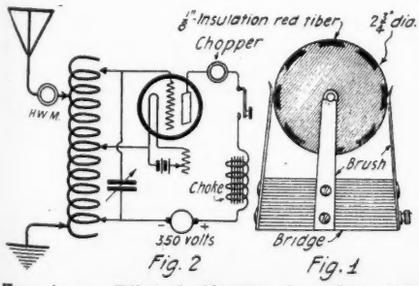

Fig. 2 Fig. 1

Here is an Efficient Chopper for That C.W. Set of Yours.

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Stop Daily Grind. Start silvering mirrors, auto headlights, tableware, etc. Plans free, Clarence Sprinkle, Dept. 64, Marion, Indiana.

Earn $25 Weekly, spare time, writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 5665, St. Louis, Mo.

Be a Mirror Expert, $3-$10 a day; spare time home at first; no capital; we train, start you making and silvering mirrors, French method. Free prospectus. W. R. Derr, Pres., 579 Decatur St., Brooklyn, N. Y.

If You Want More Pay—become a draftsman. The draftsman's pay is excellent, ranging from $35 to $60 a week to start with opportunities for promotion to as high as $100 a week or more, according to ability displayed. If you are a man of ordinary intelligence and will follow my simple, practical instructions for a few months I can train you to qualify for a highly paid position in the drafting department of any of the large industrial concerns, machine shops, ship building establishments, railroads, automobile companies, engineering or construction firms. I will give you this training by mail, at your home, in your spare time and will furnish you with a complete set of Mechanical Drawing instruments. When you complete my course of instruction our Student Employment Bureau will help you to secure a desirable position at a substantial salary. Hundreds of my graduates are now holding responsible positions in every state from Maine to California. Men whom I have trained are always in demand—big concerns want them—with my training and endorsement your success as a draftsman will be assured. Write me today for a Free Copy of my new book "Your Future in Drafting" and full particulars. Write today. Roy C. Claffin, President, Columbia School of Drafting, Dept. 1610, Washington, D. C.

Detectives Earn Big Money. Excellent opportunity. Travel. Experience unnecessary. Particulars free. Write, American Detective System, 1968 Broadway, N. Y.

Ambitious Men, write today for attractive proposition, selling subscriptions to America's most popular automobile magazine. Every car owner, mechanic, garageman interested. Quick and easy to sell. 100% profit. Pleasant work. Devote all or spare time. Automobile Digest, A528 Butler Bldg., Cincinnati.

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Learn Chemistry at Home—Dr. T. O'Conor Sloane, noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See our full page ad on page 619 of this issue. Chemical Institute of New York, 140 Liberty Street, New York City.

Play Mouth-Organ.—Complete, easy instructor, 25c. Elsea Co., Bowling Green, Ohio.

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Be a Detective, earn big money! Send one dollar for one year's membership to Continental Secret Service System, Eighth Floor, 20 East Jackson Blvd., Chicago.

Efficiency Chart.—One side instantaneous stock ordering chart; other side, spark method of testing steel. Price One Dollar, cash. A. E. Wrigley, 225 90th Street, Brooklyn, New York.

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Cornetists, Trombonists, Saxophonists, Clarinetists, send for "Free Pointers", mention instrument. Virtuoso School, Buffalo, N. Y.

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Play Safe With Your Health. Prevent colds and their consequences like pneumonia, tuberculosis, bronchitis, etc. Instructive copy explains colds, their cause, prevention and treatments. Price dollar per copy. Delay may mean your destruction. Decide! Sigmund Zyda, Vanrhall, N. J.

Tobacco or Snuff Habit Cured or no pay; $1 if cured. Remedy sent on trial. Superba Co., SB, Baltimore, Md.

Pyorrhea (Rigg's disease—bleeding or swollen gums)—hundreds have been helped by "Pyorrdent" the successful home pyorrhea treatment. Purifying, healing, preventative. Full month's treatment, consisting of a very beneficial massage paste and an antiseptic tooth-cleansing paste to be used in place of your ordinary dentrifice, together with full directions for treatment. $1 postpaid. Or write for free booklet "R." Pyorrdent Mfg. Co., 439 Seventh St., Brooklyn, N. Y

Men—Are you interested in your health? Keep well by preventing disease in time. Postpaid, sealed, with full directions sent for $1. Send for free circulars. National Specialties, R32 Union Square, N. Y. C.

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Patterns, wood and metal models, tools and dies. Brass and aluminum castings, general machine work. Write Modern Machine & Pattern Co., Terre Haute, Ind.

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Earn $25 Weekly, spare time, writing for newspapers, magazines. Experience unnecessary; details free. Press Syndicate, 566 St. Louis, Mo.

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Multigraphs, Typewriters, Addressing Machines, Duplicators, Folders, Sealers, Check Writers, Dictaphones, Office Equipment. Bought, sold, exchanged, rebuilt. Pruitt Company, 110 North LaSalle, Chicago.

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Printing.—The Better Kind. Special! 100 each of Letterheads, Envelopes and Business or Calling Cards, prepaid, $1.75. The Olde Tye Press, RN 328 Richards Ave., Dover, N. J.

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Patents.—Electrical cases a specialty. Pre-war charges. B. P. Fishburne, 340 McGill Bldg., Washington, D. C.

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Settings for all operas and plays. Catalog. Amelia Grain, Philadelphia.

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Song Writers!—Learn of the public's demand for songs suitable for dancing and the opportunities greatly changed conditions offer new writers, obtainable only in our "Song Writers' Manual and Guide," sent free. Submit your ideas for songs at once for free criticism and advice. We revise poems, compose music, secure copyright and facilitate free publication or outright sale of songs. Knickerbocker Studios, 319 Gaiety Bldg., New York.

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Universal Packet, 100 varieties all over the world, 10 cents. Cobert Stamp, 39 State, Rochester, N. Y.

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Telegraphy—(Morse and Wireless) and Railway Accounting taught thoroughly. Big salaries. Great opportunities. Oldest, largest school. All expenses low—can earn large part. Catalog free. Dodge's Institute, M St., Valparaiso, Indiana.

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Mail Old Gold, unusued postage, war and thrift stamps, Liberty Bonds, silver, platinum, diamonds, jewelry, watches, false teeth, magneto points, etc., new or broken. Cash immediately. Held ten days, returned if unsatisfactory. Ohio Smelting Co., 207 Lennox Bldg., Cleveland, Ohio.

Wireless.

Attention! Write us before you buy," lowest price on telephone receivers, transmitters, condensers and induction coils. We have contract with some of the largest manufacturers in the country. Let us give you proof by our quotations. The Electrodynamic Dyaphram Co. (Not Inc.), 1633 W. Madison St., Chicago, Ill.

Radio Storage Batteries. 6 volt 40-60 amp., $10 6 volt 60-80 amp., $12. All brand new and guaranteed W. & G. Tufts, 336 Newbury St., Boston, Mass.

Stop! Look! and Act!—V.T's. and Accessories. With each of the listed tubes—radiotron U.V. 200, $5, and A. P. Moorhead detectors, $5; radiotron U.V. 201, $6.50 and A. P. Moorhead amplifiers, $6.50. We will supply free of charge your choice of either of these four premiums—Latest FADA Rheostat, $1; No. 810 Remler Bakelite Smooth Running Rheostat, $1; R. C. of A. Porcelain V.T. Socket, $1; Murdock V.T. Socket, improved contact type, $1. Either of the Federal single, closed or double circuit jacks listed respectively at 70c, 85c and $1, will be given as premiums with each R.C. of A. or Federal amplifying transformer, price $7 each. Fada 5 ampere Nichrome power rheostats, $1.35 or R.C. of A. porcelain V.T. socket supplied free of charge with each $8 U.V. 202, 5 watt radiotron power tubes for C.W. or radiotron transmission. We absolutely guarantee the foregoing apparatus. Only new and high grade equipment carried in stock. Unsatisfactory goods returned in five days replaced at once. All orders are filled within twelve hours and shipped postpaid and insured, thereby saving time and money. Remember us. The Kehler Radio Laboratories, Dept. R, Abilene, Kansas.

Variable Condenser Plates, 4c, washers: stationary, 5c dozen; movable, 10c dozen. Samples, 10c. Complete parts for 23 plate, $1.85; 43 plate, $2.85. Variometer and variocoupler balls, rotors and tubes, plain and wound. Estimates given on small blanking dies, punches and templates. Also special size condenser plates. Gravenstede, 84 Hancock Ave., Jersey City, N. J.

Arnold's Radio Service Station where you can buy a bulb, batteries, parts, etc., during and after business hours. Any make of set repaired. Apparatus built to order. Tel. 8931 Harlem. J. F. Arnold, 2082 Lexington Ave., N. Y.

Motors.—Have several 110-220 volt direct current 1/12 to 1 horse power, new, will sell reasonable; also some experimental apparatus, etc. Arnold, 2082 Lexington Ave., Tel. 8931 Harlem.

Twelve Hour Service. The Kehler Radio Laboratories.

Mica Grid Condensers Cap, .0005 mfd, 30c, with leak, 45c. Witteck Radio Supply, 3417 N. Hoyne Ave., Chicago.

Twelve Hour Service. The Kehler Radio Laboratories.

"Amateurs.—Used and new radio apparatus, and others. Write for particulars. S. Strobel, 3923 N. 6th St., Phila., Pa.

Look! Look! Look! Light 2-inch aerial insulators with 50,000 volt high frequency flash over and ultimate tensile strength of 350 lb. at only twenty-five cents each. Insulated top binding posts with nickel plated base complete with brass screw and washer at ten cents each. Bi-sectral wound honeycomb coils with each wire in each succeeding layer centered over the space in the layer immediately under. Twenty-five turn coil unmounted at fifty cents sizes continued up to 1500 turn coil unmounted at $2.50. The Radio Distributing Co., Abilene, Kansas.

Baldwin Phones.—Further reduction and ? Why are Baldwin Phones so sensitive? Briefly, because, 1. The small armature is pivoted and designed to act as a fulcrum when connected to the diaphragm by a small link. There is no tension or spring of metal as in ordinary receivers. 2. Four pole pieces of a single solenoid act upon both sides of a lightly balanced armature. 3. The force is concentrated at the exact center of a mica diaphragm, (identically the same as in all high grade phonograph reproducers). Original Type "C", $12; Improved Type "E", $13; Lighter Type "F", $14; antistatic Type "G", $15 Single loud speaker unit, Typ "C" without cord, $6; Type "E" single unit without cord, $6.50. With each pair of phones purchased, we will extend or give, free of charge, a one year's subscription to the Radio News or the latest Federal Universal Plug, $1.75. These well known head sets are absolutely guaranteed and subject to return within five days if not satisfactory. Postpaid, insured, twelve hour service. The Kehler Radio Laboratories, Dept. R, Abilene, Kansas.

Portable Crystal Receiving Set, complete with phone, $15. No batteries required. Hear radio concerts, voice, and telegraph signals. Order today. Laurence Radioelectric Co., Locust St, Cincinnati.

A Master Cypher, defies solution without key. Especially adapted to radio. Postpaid $1. S. F. Haynes, 212 Norwell, Dorchester, Mass.

Paragon V.T. Control.—For a limited time we are offering the unexcelled and well-known Paragon V.T. Control, regular price $6, at $5.20. Postpaid, insured, and twelve hour service. Enclose 5c for attractive booklet containing the description of all the well-known, reliable and recognized Radio Text books on the market at prices that are unequaled. Build up a good radio library. The Kehler Radio Laboratories, Dept. R, Abilene, Kansas.

Trade-Chi-Rad knock-down variometer set with a free subscription to Radio News, QST, or Radio, for $10. Port Arthur Radio Laboratory, Port Arthur, Texas

Bargain.—Grebe variocoupler, $12. Also two EMCO variometers $4 each. Buehrer, 260 St. Nicholas Ave., Brooklyn.

Exchange.—Chi-Rad knock-down variometer set with free subscription to Radio News, Radio or QST for $10. Port Arthur Radio Laboratory, Port Arthur, Texas.

Magnavox Loud Speakers.—If you are interested in broadcasting your radio music all over your house or large halls with the Type R-2 Radio Telemegaphone or Type R-3 Radio Magnavox as well as other Magnavox products, it will pay you to enclose 5 cents for bulletins and attractive prices. The Kehler Radio Laboratories, Dept. R, Abilene, Kansas.

Magnavox Tone Arm Transmitter, $22.50. Hand transmitter, $15; both for $35 and like new. One Baldwin phone sealed in 36 inch brass bell horn, $10. One Mignon RC1 tuner, $4; Western Union type relays and sounders, 50 to 150 ohms, $1.50 each. Eastman 3-C camera, plate and film pack, in leather carrying case, $12. Must sell, R. E. Chapman, McLeansboro, Ill.

(Wireless continued)

Amateur Constructors.—Stop paying high prices—build your own. Complete assembled and detailed blue prints for long and short wave tuner with photo of finished set, 50c coin. E. H. Cummings, 18 Richard St., Auburn, R. I.

Crosley V-T Socket, 60c. .0005 condenser, $1.25, with knob and dial, $1.75; rheostats, switches, etc., low prices. Circulars free. Crosley Manufacturing Company, Dept. R-7-C, Cincinnati, Ohio.

Read and Act. We carry a complete line of Radio Apparatus. We also have those parts you need for your new set. Send for lists. Devore Radio Supply Co., Gibson City, Illinois.

Memorize Continental Code in one hour. Qualify quickly for amateur license. See our ad on page 660 this issue. C. K. Dodge.

New GRL-3-18. Arc Receiving Tuner. Beats anything you have ever used. Praised by professionals. Beginners use them to learn code. Beats omnigraph. Tunes 3000-18000. And the price, only $8! Stamp for circular. Genesee Radio Laboratories, Alexander, N. Y.

5% Discount on Radio Corp., Fada, Firco, Grebe, Chelsea, Baldwin, Amrad, Federal, Brandes, Pacent, General Radio, and all standard makes. Haas, 2011 Atlantic Ave., Atlantic City, N. J.

Radio Circuits On Blueprints are Convenient. Our VT circuits, each on a separate blue print, enable you to try out a large range of proven hook-ups. Set of twelve, receiving or phone and combination transmitting, 50c. Complete set of 24 for $1. The Plan Bureau, 1929 McCausland Avenue, St. Louis, Mo.

Audion Detector and Amplifier, V.T., 50 cents. Honeycomb coil mountings, 25 cents. Back mounted rheostats, 40 cents. Composition for molding your own knobs, panels, etc. 35c pound. Send stamp for particulars. Palmers Electrical Equipment Co., Duluth, Minn.

Attention!—50 Vacuum tube hook-ups. The greatest collection of vacuum tube circuits ever brought under two covers at such insignificant cost. These diagrams will be found in the great "Rasco" catalogue, which contains raw materials and parts in a greater profusion than any other catalogue. 15c in stamps, or coin, will bring the catalogue to you. Radio Specialty Co., 96-98 Park Place, N. Y.

Boys! Don't Overlook This. The "Rasco" Baby Detector. Greatest detector ever brought out with molded base. Fully adjustable. See former advertisements in this publication, or our catalogue. Detector with Galena Crystal, complete 50c, the same detector with Radiocite Crystal 75c prepaid. Send for yours to-day. Radio Specialty Company, 96-98 Park Place, New York City.

Buy Direct.. Complete tuner and three bulb sets. Mahogany cabinets. Rogers Radio Comp., 5133 Woodworth St., Pittsburgh, Penn.

Order Murdock, Clapp Eastham, DeForest, Acme, Firco, Radio Corp, Amrad and Westinghouse apparatus from Rocheleau's Store, Baltic, Conn.

You Want a Synchronous Gap! We have a few synchronous motors of prices you can afford. 1/8, 1/5 and 1/4 HP.—220 and 110 volts. Price and full information on request. Stahl Rectifier Company, 1405 W. Jackson Blvd., Chicago, Ill.

Hurrah!!! We can now sell polished brass switch points size 7/32" complete with 1/2" machine screws for twenty cents dozen; dollar-fifty per hundred. Stratton Electric Company, 215 Federal, Greenfield, Mass.

Audion Renewals.—Any type single stem, tungsten filament, detectors repaired for $2.75; amplifiers as above, $3; 5 watt power tubes, $4; VT-1 oxide filaments and to use 20-35 volts "B", $3.50. Terms cash, or C.O.D. plus charges. Trimount Laboratory, Milford, Mass.

QRK? Hawaiian and German stations read with a single bulb. Are you satisfied with your receiving set? Would you like to build one that will receive over 6000 miles on a single bulb and quit experimenting? One that will be the equal of any regardless of claims or price? Using the instruments you now have, you will be able to duplicate the long distance records you read about every day. Get our simple diagram of a complete short and long wave receiver, 175 to 20,000 meters, with which we read Honolulu, California, German, South American French and English stations, and practically all the high powered foreign and domestic stations, amateurs as far west as New Mexico and numerous telephone and musical concerts come in good. Diagram and complete instructions, leaving nothing to guess about, will be promptly mailed for 50 cents in coin or stamps. Wire a set up and quit wasting good money. Virginia Novelty Company, Martinsburg, West Va.

Storage Batteries.—Be a battery man. We have all material and can give instructions for making them. Sample Plate, 40c. Foreign countries, 50c. Windsor Specialty Co., 5419 Windsor Ave., Chicago, Ill.

Save Money on New Amrad and Grebe Sets. Write: The Radio Shop, Winchester, Va.

Make your own receiving coils, amateur, commercial time. Full directions, blueprints, and sample coil, $1. Theodore Cutting, Campbell, Cal.

Exchange.

Don't Build that set for telephone and music until you see our simple diagram and full instructions advertised under Wireless this issue. Virginia Novelty Company.

Memorize Continental Code in one hour. Qualify quickly for amateur license. See our ad on page 660 this issue. C. K. Dodge.

Telephone and Musical Concerts. If you want to hear them get Virginia Novelty Company's simple diagram advertised under Wireless this issue.

Amateur Agents Wanted in every city and town to sell radio apparatus. A few stocking agencies still open. Delfelco, 12 Meeting Street, Pawtucket, R. I.

1 K.W. Hytone Set With Meters, perfect. $150.00. Will take loud speaker as part payment. L. G. Swenson, Oak St., Shrewsbury, Mass.

For Sale.—Omnigraph 5 dial, $13. Harold Smith, 707 Tracy St., Utica, N. Y.

Exchange.—Complete receiving outfit—value $80 for high-powered microscope. Shapiro, 630 Howard Ave., Brooklyn, N. Y.

Exchange.—Small electric hand motor drill. Universal. For wireless receiving apparatus. G. E. Van Vaultenberg, General Delivery, Chicago, Ill.

(Exchange continued)

Grebe CR2 for sale $28, or trade. R. Warren, 57 Monmouth St., Brookline, Mass.

For Sale.—Short wave regenerative set detector. Two step amplifier in cabinet with Cunningham tubes, "B" batteries, phones guaranteed. Herbert Whetsel, Lapel, Ind.

Telefunken Ship Set complete transmitter and receiver like new, $250. Navy type CW 296 transmitter—one-half Navy price, $225. Both are 1/2 K.W. 500 cycle quenched gap sets. 3 K.W. "Coffin" $25 with motor generator, $125. Leyden jars .002 mf, $1.25; Dubilier, .004, $12.50. Rotary and quenched gaps. Motor generators, etc. Henry Kienzle, 501 East 84th Street, New York.

For Sale.—Complete receiving set, $27. Write Otto Lindblood, 207 Washington St., Hibbing, Minn.

New, Latest Model, Colby's short wave regenerative tuner, $18. Ralph Leffler, Tiffin, Ohio.

For Sale.—Benwood gap, $15; 110 volt universal gap motor, $5; K.W. key, $3; 4 A & P transmitter tubes used 2 hours, $15. B. E. McDowell, R.R.7, Kokomo Ind.

For Sale.—Regenerative receiver type ZRF 175-600 meters, perfect condition. First M.O. for $30 takes it. W. G. Mulks, Whitewater, Wis.

Omnigraph.—15 dial omnigraph for sale, excellent condition, first money order of $15 (fifteen dollars) takes it. Clyde M. Rogers, 135 Quinton Blvd., Topeka, Kans.

Bargain.—Mageco (latest) short wave regenerative receiver, $28; detector and two step amplifier, cabinet type, $35. Apparatus perfect condition. Smith, 1290 Belvidere Ave., Detroit, Mich.

For Sale.—Loose coupler, 5000 meters, detector, condenser, phones, $20. Bingel, 2015 Woodbine St., Brooklyn, N. Y.

Will Exchange Movette Motion Picture Camera and Projector, complete, new and worth $135 for Standard Receiving Set with two step amplifier and horn, Westinghouse or Grebe preferred. S. C. Daugherty, Jeannette, Pa.

Exchange.—Motorcycle Engines: Indians, Harleys, Thors, Excelsiors, Merkles, Hendersons Singles, $20, Little Twins, $25; Big Twins, $35; Henderson "Fours" and Fords, $50. Running guaranteed. Gleason, 230 W. Newton, Boston, Mass.

Radiophone, 10 watt, $60 complete. Two new, selected radiotrons, hand microphone, buzzer, etc., included. In oak cabinet 12x13x7". Best looking fone on market. Less tubes, $45. Has worked 500 miles consistently. Send for details at once. W. S. Halstead, Greenridge Ave., White Plains, N. Y.

For Sale.—Complete 1/2 K.W. set, $100 sell for $50; Montclair loose coupler, $40, sell for $18; 2 Clapp-Eastham variometers, $4.50 each; other apparatus, write for particulars. John P. Kennell, P. O. Box No. 102, Passaic, N. J.

Bargain.—Radio Shop 100-24000 meter Universal receiver, $73. Detector two step amplifier one detector, and two amplifier tubes new, $38. Lot cost $158, sell $97. Guaranteed first class condition. E. S. Hunter, 1114 Floyd Ave., Richmond, Va.

Bargain.—DeForest nine-panel set with vernier condenser, bulb, B batteries and coils, $65. P. Gleason, Chillicothe, Illinois.

Amateurs Interested in high grade crystal detector receiving set, with aerial, insulators, complete, write Karl Gillmann, Marathon, Wis.

For Sale.—Long wave autodyne receiver 2000-17000 meters. Complete on Brown bakelite panels—oak cabinet—bank wound coils—detector—oscillator and three-stage amplifier, which can be used separately if desired. Price $90. Photographs and detailed information. May be obtained by writing M. K. Zinn, No. 1111, 195 Broadway, N. Y. City.

Grebe CR-5 For Sale, $60. Also Grebe 2 step amplifier RORJ, $40. Factory condition and appearance. W. R. McLean, Hillsboro, Illinois.

Rare Bargain.—A 15 watt radiofone and C.W. set, finest workmanship, automatic relay control, call and be convinced. Sacrifice $90. Frank McGee, 376 Montgomery St., Brooklyn, N. Y.

Sell or Trade.—New Shaw Bike Motor, 6 x 9 printing press complete, new victrola, new Harley twin motor, D. C. generators, A. C. motors, storage batteries, self starters, magnetos, all kinds of electrical apparatus and equipment. Ask for list. What have you to trade? Lesmeister Electric Shop, Harvey, No. Dak.

Wanted.—Omnigraph—good condition, any number dials; give best price for quick sale. P.C.L.—Radio Exchange, 707 Sycamore St., E., Kokomo, Ind.

Will Trade, Brandes phones, aerial, condensers, etc., for Omnigraph No. 2, must be O. K. Write for list. C. E. Lucas, Elkton, Md.

Hawkins Electrical Guides, excellent condition, $8 prepaid. Forrest Richards, 206-16 Ave. N, Nampa, Idaho.

Regenerative Tuner, detector and two step, $55. Or sold separately. Allen Prescott, 205 Clarke St., Syracuse, N. Y.

Omnigraph, New.—5 dial practice buzzer transformer and phones, $12. A. Meyers, 5314 6th Ave., Brooklyn, N. Y.

Sell.—1/2 K.W. sending set. Complete R.S.G. included, $50. R. A. Reinbart, 60 Rivoli Street, San Francisco, Calif.

Mignon Receiver. Wave length range 200 to 10 000 meters. Excellent condition. Will sell for $30. Write for description. Albert Strohmeyer, 3120 Carson Avenue, Indianapolis, Ind.

Bargain.—Triple coil tuner, $31. Duo-lateral coils from L25 to L1500, $30 or trade for Grebe CR3. Strawn Electric Co., Calexico, Calif.

For Sale.—Bell gap, $45; Dubilier D103, $40; Metor key 5 K.W., $4. Used four hours. Paragon R.A.-10, $60. Detector and two step, $35. J-Ray gap, $38; Sink motor, $25; 6 volt 50 ampere hour battery, $14; 1/4 H.P. induction motor ,$20; O.T., $12; also excellent transformer and plate glass condenser, selling out cash only. R. Stewart, No. 5 Kron Flats, West Lafayette, Indiana.

Selling Out.—Regenerative: "Fsco" variometers and coupler in Oaken cabinet. First money order for $30 takes it. Schafer, 513 52nd St., Milwaukee, Wis.

(Continued on page 672)

THE
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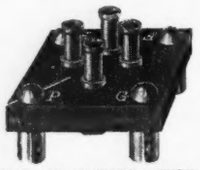
SOCKET



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MINIATURE PLUG. Polished bakelite shell over brass plug. Use socket pins for jacks. A beautiful little plug and fine for battery control or other switching purpose. The price is only 25 cents Postpaid.
TELEPHONE RECEIVER TIP JACKS. Something new. Jacks are similar to socket pins. Set of four mounted on bakelite base for connecting two receivers in series. 55 cents mail postpaid. Cord tip pin jacks only 10 cents each.
C.W. INDUCTANCE. Wind your own. Bakelite tube black 6" by 4" with 1/16" wall while they last. 96 cents each. Add 10 cents postage and packing.
BAKELITE PANELS GENUINE grade XX black polished. 5" by 5", 5" by 10", and multiples of above smooth edge accurately cut ⅛" thick 2 cents per sq. inch; 3/16" thick 3 cents per sq. inch; ¼" thick 4 cents per sq. inch. Add 15 per cent. if size other than above is desired.
ENGRAVING AND DRILLING. Letters, arrows, dials. Send sketch for estimate.
SWITCH POINTS. ¼" by 3/16" head, ⅝" shank, 6-32 thread, nickel plated with nut. $2.90 per 100 or 36 cents per doz. Shipping weight 5 oz. per dozen. Only a few, order now.

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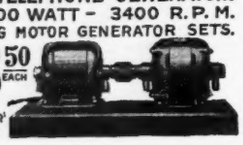

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(Continued from page 677)

(Exchange continued)

Bargain.—Improved Navy type receiving transformer, $15; Murdock phones, 2000 ohm, $3; three radiotron U.V. 200 vacuum tubes, never used, $4 each. Service Radio School Correspondence Course, $15. Six Victor-Marconi records, $3. Everything good condition. Austin Randall, Bradford Ctr., Me.

Glace Bay Loose Coupler, 5000 meters, Jason Somerville, Littleton, N. H.

Clapp-Eastham, ¼ K.W. transformer, $10. Miss Soberg, Bushwick Evening Trade School, Brooklyn.

Radiocraft 2 Step Amplifier, perfect condition. Cost $50. Sell $25. Joseph Tobin, 2103 N. Hope St., Philadelphia.

Speed Lathe and Saw Attachment almost new. Cost $36. First check for $15 takes it. Will trade on motorcycle. S. VanBlaricom, Blackfort, Idaho.

1 K.W. Thordarson Transformer, $20, three sections Murdock condenser, good generators. Big list. Harold Walker, 41 St. John Ave., Binghomton, New York.

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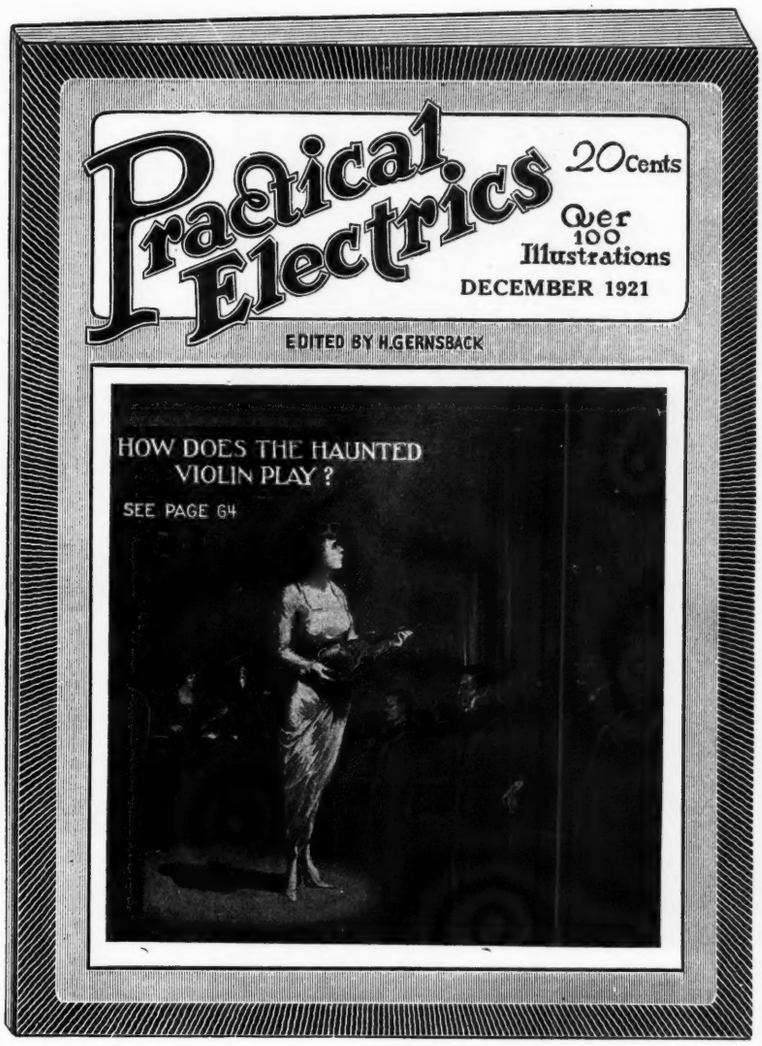

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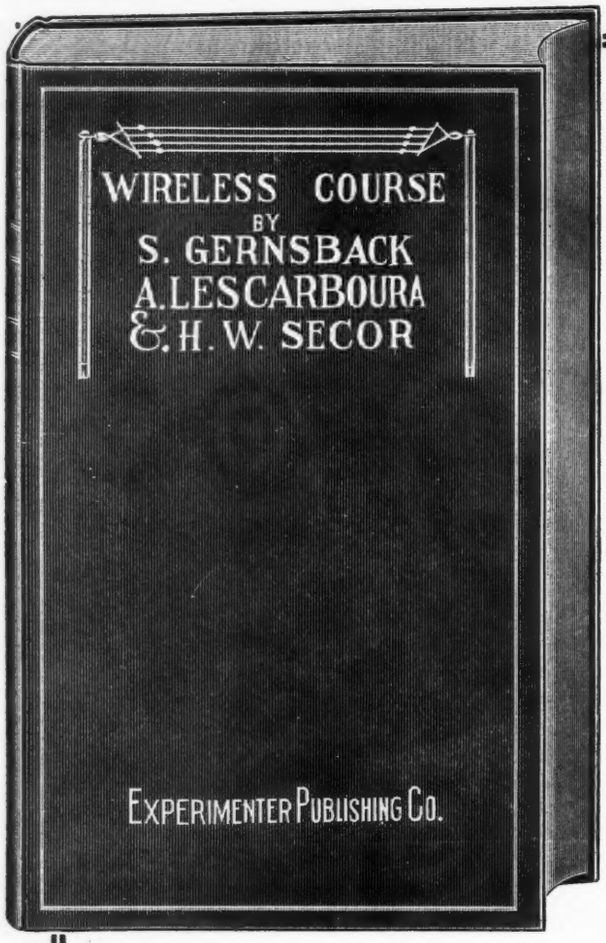

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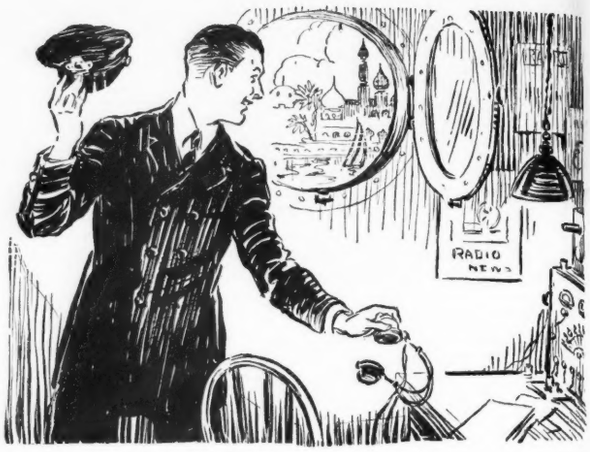

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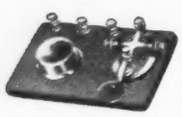

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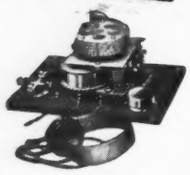

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